Manual of Surgery Vol. III.

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A
MANUAL OF SURGERY.

In Treatises by Various Authors.

IN THREE VOLUMES.

EDITED BY

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Volume III.

THE THORAX—THE ORGANS OF DIGESTION—THE
GENITO-URINARY ORGANS.

ILLUSTRATED WITH 57 ENGRAVINGS.

CASSELL & COMPANY, LIMITED:
LONDON, PARIS, NEW YORK & MELBOURNE.
1886.

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MANUAL OF SURGERY.

VOLUME III.

I. THE SURGERY OF THE CHEST.

A. PEARCE GOULD.

CONTUSIONS OF THE CHEST.

THESE injuries are of great frequency; they are caused by blows and falls of all kinds. Their chief importance arises from the effects that may be produced upon the contained viscera. They are classified according to the parts injured.

1. **Contusions of the chest walls only.**—The simplest cases are those of superficial ecchymosis and bruising; more important are cases in which the muscles are bruised or torn, and their contraction rendered painful; the pain may continue for some time (myalgia), and if the injury to the muscle is severe or extensive, it may seriously embarrass respiration. In many cases the ribs, cartilages, and sternum are fractured; these injuries are separately considered. Desprès records a case in which a contusion of the front of the chest was fatal without any fracture or lesion of the thoracic contents. *Abscess* in the chest wall may follow contusion.

2. **Injury of the pleura and lung.**—The pleura may be ecchymosed and subsequently inflamed (*pleurisy*). The *lung may be contused without laceration*

of the pleura; if the injury is slight it causes moderate dyspnœa and slight cough, with expectoration of rusty and sooty sputa in a day or two. When the injury is more extensive it leads to severe spasmodic dyspnœa and cough with hæmoptysis, and examination of the chest reveals slight local dulness with moist râles. A subpleural rupture of the lung may lead to an escape of air beneath the serous membrane, which, passing to the root of the lung and mediastinum, may thence spread to the cellular tissue of the root of the neck and back; the position in which this subcutaneous emphysema appears distinguishes it from that due to wound of the lung.

The lung may be ruptured, that is, bruised, with tearing of the pulmonary pleura; this causes an escape of blood and of air into the pleural cavity (hæmo-pneumo-thorax). In some cases the pneumo-thorax predominates, in others the hæmo-thorax, the difference probably depending upon the position and character of the rupture, and whether large vessels are torn. In the severest cases the lung is extensively torn and contused, and its function wholly interfered with.

The secondary consequences of these injuries of the lung are traumatic pneumonia, pulmonary abscess, and gangrene of the lung.

3. **Injuries of the pericardium and heart** are rarer than of the lungs. The pericardium may be torn, the muscular tissue of the heart may be bruised or torn, most often on the right side; the chordæ tendineæ or one of the valves may be torn, or one of the great vessels may be torn across. Ruptures of the heart and great vessels are quickly fatal from hæmorrhage; rupture of the pericardium may be recovered from; lesions of the valves interfering with their competency are sooner or later fatal.

4. **Injury of the mediastinum** may lead to mediastinal abscess. (*See* page 17.)

FRACTURES OF THE RIBS AND STERNUM.

Etiology.—In children and young persons the great elasticity of the chest walls protects them from fracture, even under extreme violence; but as age advances, the increasing rigidity of the chest renders fracture more common. In general paralysis of the insane a special fragility of the ribs is sometimes met with. The cause of the fracture may be *direct violence*, such as blows and gun-shot injuries; *indirect violence*, the chest being compressed and the ribs snapping across; or *muscular action* in parturition and severe coughing.

Pathology.—The ribs most often affected are the fourth to the eighth; the highest are protected by the clavicle and shoulder, and the lowest by their extreme mobility. The fracture may implicate one or many ribs, may be simple, comminuted, or compound either externally or into the lung. When the result of indirect violence, the ribs are most often broken near their angle, and the broken ends are displaced outwards; when direct violence is the cause, the fracture may be in any part of the rib, but is most common in the anterior third, and there is a danger of the broken ends being displaced inwards and injuring the pleura, lung, diaphragm, liver, or stomach.

Union is generally firm in three to four weeks; the callus thrown out is often abundant, ensheathing the fragments, or even uniting adjacent ribs across the intercostal space. "False joint" and "fibrous union" have been very rarely observed.

Symptoms.—The patient sometimes feels distinctly the snap of the fracture. The most constant symptom is a sharp cutting pain at the seat of fracture, intensified by respiration, cough, or compression of the chest. Crepitus can sometimes be elicited either by pressure immediately over the fracture, by deep inspiration or cough, or by firm pressure upon the rib at a distance. Acute tenderness immediately over the fracture is always a marked sign; displacement may be detected, especially if several ribs are broken; emphysema from wound of lung is so frequent as to be a useful sign.

Complications.—External wound, laceration of intercostal artery, wound of pleura, pleurisy, wound of lung, emphysema, pneumo-thorax, hæmoptysis, hæmothorax, pneumonia, wound of diaphragm, hiccough, wound of liver, hæmorrhage, peritonitis. The embarrassment of respiration from fractured ribs becomes of serious moment in those in whom it is already impeded by pulmonary emphysema and bronchitis.

Treatment.—The usual plan is to fix the injured region of the chest more or less securely, by strapping the side, or by a broad roller applied round the chest. Where this increases the pain and dyspnœa it should be removed, and when the ends of the broken bone are driven inwards, pressure should not be employed. In patients with advanced pulmonary emphysema, fixation of the chest dangerously adds to the respiratory difficulty. Unless complicated with a wound, no attempt should be made to elevate depressed fragments.

Fracture of costal cartilages is occasionally met with as a result of direct violence. The line of fracture is clean and vertical; it may separate the cartilage from the rib. If there is much displacement, the sternal fragment is in front of the spinal. These fractures can be readily recognised by pain, mobility, and more or less displacement. Union is by bone. The treatment is the same as that of broken ribs.

Dislocation of a costal cartilage on to the sternum is a very rare accident, of which I recently saw an example; reduction was impossible.

Fracture of the sternum may be caused by severe *direct violence ;* by *indirect violence*, such as falls on the back, buttocks, or feet, by which the trunk is violently bent back or forwards ; or by *muscular action* in parturition or coughing. The fracture is usually transverse, but may be oblique ; both forms are seen in a specimen in the Middlesex Hospital museum, which is drawn in Fig. 1. The injury may separate the manubrium from the gladiolus, but the most frequent site of the fracture is in the latter portion of the bone. If there is displacement, the lower fragment generally rides forward over the upper ; the reverse is rare. The fracture is usually easily recognised by displacement and crepitus ; emphysema from wound of the lung may complicate it, and suppuration in the anterior mediastinum is a more serious sequela. The *treatment* consists in rest in bed, and circular compression of the chest, as for broken ribs ; when caused by over-bending of the body, fracture of the spine is associated with that of the sternum.

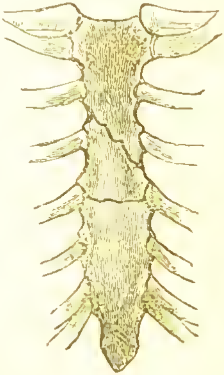

Fig. 1.—Posterior Surface of a Sternum, showing a complete transverse fracture opposite the fourth costal cartilage, and an incomplete oblique fracture through the posterior part of the bone only, opposite the third costal cartilage.

WOUNDS OF THE THORAX.

These are produced by stabs and gun-shots of various kinds. They derive their importance from the injury inflicted upon the thoracic viscera, and hence they are classified into *non-penetrating* and *penetrating*, the former being of no special gravity, the latter always being very grave. To determine whether a given wound penetrates the chest walls may be very easy or very difficult; the nature of the injury and the position of the wound should be carefully studied, and signs of wound of the thoracic viscera, especially the lungs, should be sought. No examination with a probe is permissible, but the finger may be carefully used to explore a wound, and if the surgeon is still in doubt he must wait and watch for the inflammatory sequelæ of perforating wounds.

The *treatment* of non-penetrating wounds presents no special peculiarities; the constant respiratory movements delay healing in many cases. Where there is penetration, the treatment of the injured thoracic viscera becomes the main indication.

Wound of the pleura without injury to the lung is a rare accident. It may be caused by a blunt weapon pushing the soft and yielding lung before it, or by the pleural sac being opened beyond the edge of the lung. The pleura extends down in the back as low as the twelfth rib, or even lower than this, while the lung does not reach lower than the tenth rib, and perforating wounds in the tenth and eleventh intercostal spaces open the serous cavity without injury to the lung. As the diaphragm is in contact with the chest walls below the lungs, any injury here is liable to wound this muscle and the liver or spleen beneath it. The signs of a wound of the pleura are, in some cases, protrusion of the lung, in others moderate emphysema, pneumo-thorax, or traumatopnœa without hæmoptysis or hæmo-thorax; as well as the subsequent occurrence of pleurisy.

If uncomplicated, the *treatment* consists in closure of the wound after careful antiseptic cleansing.

Wound of the lung may be caused by the sharp fragments of a broken rib, as well as by stabs or gunshots. The symptoms are due to escape of blood and air from the severed pulmonary tissue. The blood is partly coughed up (*hæmoptysis*) and partly escapes externally, or accumulates in the pleural cavity (*hæmo-thorax*). The hæmorrhage varies greatly in amount; in some cases it is slight, in others, when the wound involves the large vessels near the root of the lung, death is almost instantaneous, the rush of blood into the bronchi suffocating the patient. The air escaping from the lung may accumulate in the pleura (*pneumo-thorax*) or may infiltrate the subcutaneous cellular tissue (*emphysema*); when it passes freely in and out of a wound in the chest, the phenomenon is known as *traumatopnœa;* this is accompanied with a peculiar sucking, hissing, or bubbling sound. Incised wounds in the lungs are quickly sealed by blood clot, which is then infiltrated with lymph, and forms a cicatrix, which after a short time becomes recognisable only with difficulty. The contused lacerated wounds produced by bullets, and which are often complicated by the lodgment of foreign bodies, are much more grave, as healing cannot take place so readily, and is liable to be attended with suppuration and septic pneumonia. The *treatment* of the injury to the lung, apart from the complications associated with it, consists in observing the utmost possible rest until the wound is healed.

Wounds of the pericardium may be inflicted without injury to the contained viscus; they are followed by pericarditis.

Wounds of the heart are much less frequent than those of the lung; they are generally immediately fatal from shock and hæmorrhage. But many instances are recorded of patients who have survived some days or weeks after wounds of the heart or the lodgment of foreign bodies in it. The right ventricle is the part most often injured, and transverse wounds are more fatal than those in the axis of the organ; wounds of the auricle are speedily fatal. The symptoms in these cases are profound shock, with a very feeble irregular pulse. The heart sounds are weak and altered, and there is great dyspnœa. If the patient survives, signs of pericarditis or endocarditis supervene.

Wounds of the great vessels are almost without exception immediately fatal from hæmorrhage.

Wounds of the œsophagus in the chest are rare, and generally complicated with injury to other viscera; they are recognised by the escape from the wound of fluids swallowed. The patient should be fed by the rectum until the wound is healed.

Wounds of the thoracic duct are followed by the escape of lymph and chyle from the wound; unless fatal from other injuries, death results from inanition.

Wounds and ruptures of the diaphragm are produced by stabs, gun-shot wounds, and severe contusions. They are generally complicated by lesions of the thoracic or abdominal viscera, which quickly cause death; if not, a hernial protrusion, most often of the stomach and colon or small intestine, more rarely the spleen or liver, takes place into the chest; such a *diaphragmatic hernia* may become strangulated. The rupture of the muscle is most frequent on the left side.

PRIMARY COMPLICATIONS OF WOUNDS OF THE CHEST.

(1) **External hæmorrhage** from wound of a parietal vessel, or of one of the viscera. The intercostal vessels run along the lower borders of the ribs, and are protected from injury. When wounded the blood usually spurts out *per saltum*, and the bleeding is arrested by pressing with the finger against the lower border of the rib. To distinguish hæmorrhage from the chest wall from bleeding from the lung, Richter recommends that a folded card should be introduced deep into the wound, with its concavity directed upwards. Blood from a wounded intercostal artery will flow out along the channel of the card

only, while that from the thoracic cavity will escape around the card. The bleeding should be arrested by forcipressure if the vessel can be seized; if not, a tampon may be introduced into the wound. If these means fail, the wound should be enlarged along the rib, and the periosteum separated from the lower half of the rib; this membrane will carry with it the intercostal vessels, which can then be tied, or a piece of the rib may be excised.

The *internal mammary artery* may be injured by wounds close to the edge of the sternum; the blood may escape externally, or into the pleura, pericardium, or mediastinum. The hæmorrhage is to be arrested by forcipressure, or by ligature of the artery in the wound.

Wounds of the lung may cause profuse external hæmorrhage, the amount varying with the extent and position of the wound, and the freedom with which the blood can escape externally. Such hæmorrhage is most abundant during expiration, and the blood is frothy from admixture with air; cough, hæmoptysis, dyspnœa, traumatopnœa, and general distress, or threatened syncope, also point to the injury to the lung. If possible the wound should be closed, and the patient placed on the injured side, and then every care should be taken to calm excitement and to prevent movement or talking. When the wound cannot be at once closed, it should be cleansed, and a firm dressing be fixed over it. In this way the movement of the injured lung is reduced to a minimum, and if the blood accumulates in the pleura it compresses the lung, and so arrests the hæmorrhage. Inhalation of turpentine and the subcutaneous injection of ergotine should be employed when the bleeding is profuse.

2. **Internal hæmorrhage.**—(*a*) *Hæmo-thorax*, or effusion of blood in the pleura. The usual cause of hæmo-thorax is a lesion of the lung and pulmonary

pleura; but a wound of an intercostal artery, or the internal mammary artery, may induce it. The blood collects in the lowest part of the serous cavity, and gradually pushes the lung aside. Blood in the pleura speedily coagulates, and is then rapidly absorbed, with little irritation of the serous membrane. If, however, air is admitted to the pleura from the outside, there is a great danger of decomposition of the blood and acute purulent inflammation; air that escapes through a wound in the lung is so thoroughly filtered that it does not set up decomposition of the blood. *The signs* of hæmo-thorax are dulness in the lower part of the chest, with loss of vocal fremitus and resonance, and distant weak bronchial or absent breath sound; there may be great dyspnœa and general signs of loss of blood; these symptoms come on quickly after an injury. In many cases ecchymosis of the loin is noticed a few days later from transudation of the blood. Hæmo-thorax may be combined with pneumothorax.

Treatment.—The first indication is to stop the hæmorrhage. Should the accumulation of blood in the pleura threaten suffocation, the wound should be opened or enlarged, or if no wound exists a free incision be made, and the clots allowed to escape; the necessity for such a step can only very rarely arise. If signs of suppuration supervene (fever, rigors, superficial œdema, increasing dulness and respiratory difficulty), the mixture of pus and blood should be liberated by a free incision and antiseptic drainage, or by opening up the original wound.

(*b*) *Hæmo-pericardium* is accumulation of blood in the pericardium from wound of the heart, of a coronary artery, or of the internal mammary artery. It occasions great embarrassment of the circulation, with increased cardiac dulness, loss of the heart's impulse, and enfeeblement of the heart sounds.

(*c*) *Hæmo-mediastinum*, or effusion of blood in the mediastinum, is a very rare condition.

3. **Hæmoptysis** occurs from wounds of the lungs; it may be very slight or profuse, and may be fatal from the blood filling the bronchi.

4. **Pneumo-thorax,** or escape of air into the pleural cavity, may be caused by an external wound opening the pleura, or by a wound or rupture of the lung and visceral pleura.

When there is an external wound, air passes into the pleural sac with each inspiration; when there is a wound in the lung air is passed through it into the pleura with each expiration until the resistance to its escape equals that opposed by the narrow orifice of the glottis. As the air accumulates the lung collapses and respiration is greatly embarrassed. Under favourable circumstances the air is absorbed, the oxygen being first removed and replaced by carbonic acid gas. When due to an external wound suppuration is liable to occur and *pyo-pneumo-thorax* results.

The *signs* of pneumo-thorax are dyspnœa and orthopnœa, distension of one side of the chest, which is tympanitic on percussion; over the same area the respiratory murmur is lost or amphoric, the voice sound is amphoric, bronchial râles have a metallic tinkle, and the "bell sound" is heard when one copper coin is struck against another placed on the chest. When pneumothorax threatens life by suffocation, the cavity of the pleura should be opened by a trocar and canula; in one such case under my care the air escaped with a hissing sound, and the lung at once expanded almost to its full extent.

5. **Emphysema** is the name given to the infiltration of air in the cellular tissue. It may be produced in the following ways:

(1) *Subpleural rupture of the lung.*—Air escaping from the air cells passes along the interalveolar tissue

to the root of the lung, and thence by way of the mediastinum to the root of the neck, whence it spreads over the shoulders and trunk. This is a rare accident.

(2) *A valvular wound* through the chest walls into the pleural sac: air passes into the pleura without difficulty during inspiration; when expiration follows it is unable to escape externally, and it accordingly infiltrates the cellular tissue. The conditions are still more favourable when at the same time the lung is wounded.

(3) *A subcutaneous wound of the lung*, as when the fragments of a broken rib lacerate it: air may then pass into the pleura with each inspiration; during expiration the wound of the lung is closed as by a valve, and the air is forced out through a wound in the parietal pleura, whence it passes into the subcutaneous tissue. In many cases of emphysema there is no accompanying pneumo-thorax, but the air passes directly from the lungs to the chest walls. This is generally explained by the wound of the lung having occurred at the seat of an old adhesion; the air then passes along this adhesion and is shut off from the general pleural cavity.

(4) In rare cases of *non-penetrating wounds of the chest wall* air is sucked in during inspiration, and, owing to the valvular nature of the wound, with every expiration is forced farther and farther into the cellular tissue; this can only happen in the case of sinuous wounds.

Symptoms.—The presence of the air causes a soft ill-defined swelling of the chest wall; the skin over it is of healthy colour; on light percussion the note elicited is hyper-resonant or tympanitic in character, the swelling is unaltered by a strong inspiration or expiration, and on compressing it a fine dry crepitation is plainly felt, caused by the passage of the air from space to space in the cellular tissue. When due to subpleural rupture the swelling appears first at the neck; when due to a wound of the lung it is first noticed around the wound. As a rule, the swelling attains only a moderate size, but it may extend all over the body and cause great embarrassment to respiration and circulation, and even be fatal in its effects.

Treatment.—When slight, nothing is required beyond the application of strapping or a bandage to the chest. If the emphysema is very extensive and causing inconvenience, multiple punctures in the skin will allow the air to escape.

6. **Prolapse of the lung**, or protrusion of a part of the lung through a wound in the thoracic walls, may occur in any case in which the pleural cavity is opened; it is a rare accident, and is most likely to occur in extensive wounds. The protrusion occurs during expiration, and is probably caused by the air expelled from the opposite lung passing into the injured lung and distending it where it has lost its usual support. The prolapsed mass varies in size; it is smooth on the surface, dark in colour, crepitates when compressed, and expands with forced expiration or a cough; it may be reducible on gentle pressure. The protruded mass becomes congested and eventually gangrenous, the pleura at its base becoming adherent to the costal pleura.

Treatment.—If seen early, reduction should be attempted. If this is impossible, or if the lung is too seriously congested to render it safe to return it, it may be left to nature to detach the sphacelus, or the surgeon may remove it after applying a stout ligature to the base.

7. **Foreign bodies in the thorax.**—Bullets of various kinds and portions of dress are the most common foreign bodies introduced into the thorax.

These, in the chest walls, present no special peculiarities. Bullets in the pleura fall to the bottom of the serous sac unless prevented by pleural adhesions; they are apt to excite purulent pleurisy. Owing to the impossibility of determining their position, as well as to their innocuousness in some cases, no effort should be made to remove them at once. If empyema occurs, a free incision should be made and the pus and foreign body evacuated. Foreign bodies in the lung may become encysted and remain innocuous, or they may excite a localised suppuration, the abscess discharging through the bronchi or externally, and healing up after the expulsion of the foreign body. They may set up rapidly fatal spreading pneumonia. If the track of the wound is distinct, and the foreign body can be plainly detected, very gentle careful efforts may be made to remove it; in other cases the surgeon should leave the foreign body alone, and wait.

SECONDARY COMPLICATIONS OF INJURIES OF THE CHEST.

1. **Subpectoral abscess.**—As a result of contusion of the front of the chest, with or without laceration of the pectoral muscles, inflammation of the cellular tissue between and beneath these muscles may occur and run on to suppuration. The inflammation occasions a painful swelling of the part, with œdema of the skin, and great pain in attempting to raise the arm in front of the body. Owing to the great depth of the pus fluctuation may not be detected.

Treatment.—The pus should be evacuated early, and a grooved needle may be introduced to determine its presence. If possible, the incision should be made from the axilla; but if the abscess does not project in this direction it must be opened from the front. In either case, after the division of the skin a director should be pushed through the deeper tissues until pus appears in its groove, and along it dressing forceps should be passed and opened widely to expand the deeper part of the wound.

2. **Peripleuritic abscess** is a very rare sequel of contusions and punctured wounds of the chest. The pus forms between the pleura and the ribs, and generally points externally, but may burst into the pleura or mediastinum; it is therefore necessary to open the abscess as soon as it is recognised.

3. **Pleurisy** ensues upon all wounds of the pleura; if the injury is subcutaneous, as in many cases of fractured ribs, the traumatic inflammation is dry, and gives rise only to pain and a friction sound heard over a limited area of the chest. The two surfaces of the membrane adhere, and to some extent close the serous sac. When, however, external air is admitted into the pleura, and especially when blood clot or a foreign body is also lodged in the sac, decomposition occurs, and acute inflammation is excited. The fluid at first is serous but slightly turbid and flaky, but quickly becomes purulent. *Empyema.*—This acute inflammation of the pleura is attended with high fever, and the formation of pus may be marked by the occurrence of one or more rigors. The local signs are dulness on percussion over the lower part of the chest, which gradually increases in extent upwards, either absence of breath sounds over the same area, or weak distant bronchial or tubular breathing and loss of vocal fremitus. If the wound is closed, the side is enlarged, and neighbouring viscera, such as the heart and liver, are displaced; if the wound remains open, there is an abundant and often a very profuse discharge of fluid from it.

Treatment.—Dry pleurisy occurring with fracture of ribs requires no special treatment; the fixation of the part indicated by the fracture will also relieve the pain of the serous inflammation. When, however, acute purulent pleurisy arises, active surgical treatment is called for. If there is a wound it should be enlarged, and any foreign bodies, blood clots, or pus removed, and the cavity cleaned with some antiseptic lotion such as dilute Condy's fluid or solution of bichloride of mercury; free drainage should be then secured. If the wound is in such a situation that it does not afford a proper aperture for drainage or cleansing of the cavity, a counter-opening in the lower part of the chest should be made.

4. **Pneumonia.**—All bruises and wounds of the lung are followed by a certain amount of traumatic pneumonia, which, as a rule, is limited to the injured area, and gives no sign of its existence unless extensive. When the lung is wounded by a weapon which pierces the chest walls, and external air is admitted to the injured surface, or a dirty foreign body lodges in the lung, the blood clot that seals the wound and plugs the alveoli may decompose, and the irritating products of this change will excite a more intense inflammation with a tendency to spread and to run on to suppuration. But even in these cases the inflammation may be limited in area, and may after a time subside and allow the wound to cicatrise. Traumatic pneumonia is distinguished from idiopathic lobar pneumonia by the limited area of the organ involved, and by its occurrence at any part of the lung without distinction. It may terminate in *abscess*, especially if a foreign body is impacted, or in *gangrene;* an abscess in the lung may open into a bronchus and discharge its contents through the larynx; or into the pleural sac; or may burrow its way through the chest walls and discharge its contents externally.

The *symptoms* may be entirely masked by other effects of the injury, for bruising and wound of the lung leads to rusty expectoration, and the existence of pneumo-thorax or pleurisy may obscure the physical signs of pneumonia. When the inflammation is septic, the general disturbance is severe, with high fever and rapid pulse, and the danger of death is very great. An abscess of the lung may declare itself by the sudden discharge of matter externally or by the mouth, and the usual signs of a moist cavity may then be detected. Gangrene of the lung will be recognised by the intensely foul odour of the breath.

Treatment.—Traumatic pneumonia does not call for surgical treatment.

5. **Pericarditis, endocarditis, and myocarditis,** may follow injuries of the pericardium and heart; they are usually fatal.

6. **Mediastinal abscess** is a very rare sequel of contusions or wounds of the chest; it also results from abscess beneath the deep cervical fascia, ulceration of the œsophagus, and suppuration of the lymphatic glands. The pus tends to point above, or below, or at either side of or through the sternum; but the abscess may burst into the pleura, pericardium, œsophagus, or heart. So soon as the presence of pus can be verified it should be liberated by a free incision.

7. **Hernia of the lung.—Pneumocele** is a protrusion of part of the lung through a weakened portion of the chest wall, either from severe contusion with fracture, from the yielding of a cicatrix, or a slow giving way of the intercostal muscles under the strain of frequent severe coughing. The tumour is most commonly situated in front over the fourth or fifth interspace; it is of either sudden or slow formation, soft, compressible, crepitant under the hand, resonant to percussion, shrinking with each inspiration, expanding with a distinct impulse on coughing or violent expiration. On listening over it a loud vesicular murmur is heard. The tumour is

more or less reducible. It needs to be distinguished from a "pointing" empyema. The only treatment required is external support by a well-fitting pad.

THE SURGICAL TREATMENT OF PLEURITIC EFFUSIONS.

Surgical interference with pleuritic effusions is of two kinds, tapping and drainage. Tapping is practised when the fluid is serous in character, but, except in some cases in children, empyema requires to be treated by drainage of the cavity.

1. **Tapping the pleura.**—The special objects to be kept in view in this operation are to evacuate the fluid without admitting air to the pleural sac, or inflicting injury upon important structures.

(*a*) *Choice of an instrument.*—A simple trocar and canula will evacuate the fluid, but offers no security against the access of air during an inspiratory effort. This objection to its use may be met in one of three ways. The canula may be passed through the centre of a piece of linen soaked in carbolic acid solution (five per cent.), so that on withdrawing the trocar the linen falls over the mouth of the canula; it then offers no impediment to the escape of the fluid from the chest, but it at once blocks the canula if, during an inspiration, air is drawn towards the pleura. Another plan is to have a stop-cock on the canula, and to close it immediately the trocar is withdrawn; a rubber tubing is then fastened on to the end of the canula, and allowed to fall into a vessel of carbolic solution (five per cent.); on opening the stop-cock the pleural secretion flows into this vessel, but no air can be sucked into the chest. A simpler method is to have a cross piece on the canula, to which the rubber tubing is attached, and the trocar so made that it can be withdrawn beyond the orifice of this cross tube, but no farther; this is known as a "syphon trocar." Southey's fine trocar and canula can also be used, with the end of the tubing in a vessel of carbolic solution. Better than any of these, however, is an aspirator. Of these there are many forms; the simplest is the "bottle aspirator," in which a vacuum is made in a bottle and then connected with the pleura; some prefer direct aspiration by means of a properly made syringe, and the combination of this with a syphon (the "syphon aspirator") is an exceedingly good instrument. Either a hollow needle or a trocar and canula may be used, and each instrument has its advocates and its merits. The advantage of the needle is, that if, as soon as the opening into its barrel is passed under the skin, it is connected with the vacuum of the aspirator, and the needle then steadily and slowly pushed on, as soon as the fluid is reached it appears in the bottle or barrel of the instrument, and there is no danger of thrusting the sharp needle too far. The disadvantage of the needle is its sharp point within the pleura, which may possibly scratch the expanding lung, and has been known to cause fatal hæmorrhage; this accident is little likely to happen if the instrument is used as described above. The advantage of the trocar and canula is, that the blunt end of the canula can do harm; but the disadvantage of it is, that there is no means of knowing exactly how far it should be introduced to reach the fluid.

(*b*) *Place of puncture.*—The most convenient spot is the sixth intercostal space in the mid-axillary line; but a space higher or lower may be taken, and the puncture may be made farther back if preferred. In loculated pleurisy the cavity must be tapped over the centre of the fluid accumulation, and in such cases the preliminary insertion of a fine hypodermic syringe to demonstrate the presence of fluid should always be practised; indeed, this is to be commended in all cases of pleuritic effusion submitted to operation.

(*c*) *Mode of procedure.*—The side of the chest and hands of the surgeon should be washed with carbolic lotion, and the whole aspirator or other apparatus flushed with the same. The place of puncture having been chosen, and the existence of fluid having been determined by a syringe or by auscultation and percussion, the upper border of the rib forming the lower boundary of the space to be punctured is felt for, and the skin having been drawn up or down over it, a small puncture with a knife is made through the skin, and then the needle or trocar is thrust into the pleural cavity. The fluid is then allowed to flow out or be drawn out by the aspirator. Care must be taken not to allow the evacuation to go on too rapidly, and from time to time it is well to stop the flow for a few seconds. Spasmodic cough is an indication for stopping the flow for a time, and if the fluid becomes mixed with blood the instrument should be at once removed. As the needle or canula is withdrawn a pad of boric lint should be placed over the puncture and fastened in place by strapping. Blocking of the evacuating tube by a plug of lymph is one of the accidents that may interfere with the operation; it causes an abrupt cessation of the flow of fluid, which differs from the gradual stoppage of the stream as the cavity empties. The most convenient way of removing the obstruction is to reverse the current for a moment and force the plug back into the pleura; when this is impracticable it is necessary to re-introduce the trocar or pass a stylet along the hollow needle.

2. **Draining the pleura.**—This is a more serious operation, and one that requires the administration of an anæsthetic. It consists in making a

free opening into the pleural cavity and inserting a drainage tube for the continuous escape of the secreted fluid.

(*a*) *Position of the opening.*—In loculated empyema a spot a little below the centre of the dull area is the best. In simple empyema several spots have been recommended. One that has many advocates is the fifth space in the mid-axillary line, and it is contended that this part of the pleural sac being the last to close, is therefore the best in which to place the drain. Marshall has recommended the spot immediately below and outside the junction of the fifth rib and its cartilage, on account of the thinness of the coverings of the chest at this spot ; there are no clinical facts to warrant a preference for this spot. Others choose a spot lower down and farther back, such as the seventh space in the axillary line, or the ninth space in the post-axillary line, and occasionally it is found necessary to open the lowest part of the pleural cavity, in the tenth or eleventh interspace.

(*b*) *The operation* should be conducted with full antiseptic precautions. If the ribs are widely apart, so that a good-sized drain can lie between them without being compressed, the incision should be made along the centre of an interspace, and the dissection carried steadily down to the pleura, all bleeding being stopped by ligature and torsion. The costal pleura should then be divided for the whole length of the wound, when the pus will flow out and air be sucked in. The finger should be introduced to ascertain the size and relations of the cavity, and the presence or absence of bands of adhesion across it, and then a good-sized tube without lateral openings, and long enough to reach well into the cavity, should be inserted and fastened in position. If it be determined to excise a portion of rib, it is better to make the incision along the rib, and to carry it down to the bone ; with a raspatory the periosteum can then be stripped off the bone, and with bone pliers an inch or more of rib can be cut away; should the intercostal artery be wounded it should be at once twisted or tied; the pleura is then to be incised as before. Some form of antiseptic absorbent dressing should be applied, and changed as required.

(c) *Excision of the ribs.*—This is practised for two purposes: to admit of sufficient drainage, and to allow of the falling in of the chest. It is of great value for the former purpose; without it, it is often impossible to have a sufficiently large tube lying in the pleura uncompressed by the ribs; the removal of an inch of a single rib is quite sufficient, and the bone is so quickly regenerated that it is somtimes necessary to repeat the excision. Such an operation has little or no influence upon the retraction of the chest, and if this is the surgeon's aim he must remove a considerable length of several ribs; this has been done, but the success achieved, as yet, hardly compensates for the severity of the procedure. A serious hindrance to the closure of the cavity in chronic empyema is the dense thickened false membrane lining the costal pleura, and it is a good plan to excise this thick membrane as freely as possible after the removal of a portion of one or more ribs.

(d) *The tube.*—A common rubber tube may be used, but I prefer one attached to a silver tube long enough just to reach the pleural cavity, and provided with two small rings at its outer end, by which it can be attached to the chest. A short length of tube within the cavity suffices. The rigid part of the tube remains patent, in spite of the falling in of the ribs, and keeps a free vent for the pus. If a common rubber tube is used, it may be fastened by transfixing its outer end by a hare-lip pin, or a safety pin, and then attaching these to the chest; or by passing a square piece of oiled silk or rubber tissue over the outer end of the tube, slitting this into four ends, and fastening them to the four corners of the square. When the amount of discharge is reduced to a small quantity of serous fluid, a smaller tube may be used.

(*e*) *The removal of the tube* must not be attempted too soon, as the opening in the chest wall rapidly closes, and if the pleural cavity is not closed, fluid accumulates in it and necessitates a further operation. The surgeon should therefore wait until the discharge consists of the secretion of the sinus in the chest wall only.

(*f*) *Fistulous empyema.*—Very chronic cases of fistulous empyema sometimes present themselves for treatment. The cavity should be explored, and if it is found that the opening is in an unfavourable position for drainage a counter-opening at the lowest part of the sac should be made; in all cases free drainage should be secured; excision of the ribs and thickened pleura may be practised if the inability of the chest to retract is the obstacle to cure.

THE SURGICAL TREATMENT OF PERICARDIAL EFFUSIONS.

Tapping the pericardium is now a recognised surgical procedure which has been many times carried out for pericarditis with effusion. The aspirator is the proper instrument to use. The puncture should be made in the fifth or the fourth left intercostal space, two inches from the border of the sternum. The pericardium may also be punctured close to the sternum, between that bone and the internal mammary artery. The structures to be avoided are the internal mammary and intercostal vessels, the pleura and lung, the heart and the great vessels.

Drainage of the pericardium has been practised in a few cases of pyo-pericardium. The presence of fluid should previously be demonstrated by the insertion of a fine syringe. The pericardium should then be opened by an incision carried along the upper border of the fifth or the sixth rib (the more prominent of these two spaces being selected) and having its centre two inches from the left border of the sternum. The dissection is carried carefully down until the pericardium is reached; this is then carefully but freely excised, the contained pus allowed to flow out, and a sufficiently large drainage tube inserted. Antiseptic precautions should be employed.

Injection of the pericardium with iodine solutions has been practised in a very few cases.

Pneumotomy or **opening lung cavities** is an operation which has been performed for phthisical or bronchi-ectatic cavities, for abscess or gangrene of the lung, and for hydatid tumours. Before tapping a lung, great pains must be taken to localise as exactly as possible the cavity to be opened. The operation consists of two steps: finding the cavity, and inserting within it a drain. Through an incision made down to the pleura a trocar and canula are thrust until pus or putrid gas escapes. This acts as a guide for the further steps. The exposed pleura is incised, and if the two surfaces of the pleura are adherent a fine bistoury is passed carefully in along the canula, the incision dilated by forceps, and a drainage tube inserted. Hydatid tumours of the lung may be treated by aspiration of the cyst, and if that fail, by incision and drainage.

Pigeon breast is a common deformity produced during childhood by the yielding of the chest walls under the pressure of the atmosphere during inspiration. When from any cause, such as diphtheria, chronic pulmonary catarrh, or enlarged tonsils, there is an obstruction to the entrance of air during inspiration, if the chest walls are weak they yield under external pressure, especially in the rib cartilages and at the junction between the ribs and cartilages ; when the obstruction is great, the chest may be seen to shrink during inspiration and enlarge during expiration. The deformity consists in a protrusion forwards of the sternum, and a straightening of the ribs in front of their angles ; in extreme cases the widest part of the chest is opposite the angles of the ribs. It is often combined with more or less of a lateral constriction running outwards from the xiphoid cartilage. The effect of the deformity is to lessen the size of the chest and the degree to which it expands during inspiration.

Apnœa literally signifies "breathlessness," but it should be used to denote the cessation of respiration which results from hyperoxygenation of the blood.

Asphyxia, which literally means cessation of the pulse, is always used to denote the result of a total interruption of respiration, or suffocation.

LEEDS & WEST-RIDING
MEDICO-CHIRURGICAL SOCIETY

II. AFFECTIONS OF THE MOUTH, PALATE, TONGUE, AND TONSIL.

WALTER WHITEHEAD.

I. DEFORMITIES.

IN order to understand the congenital deformities connected with the face, mouth, and pharynx, it is necessary to bear in mind a few elementary points relating to the development of these parts. In the embryo the anterior part of the alimentary canal is, at an early period of its existence, in communication with the external surface by a number of lateral slit-like openings or "branchial clefts," homologous with the gill clefts of fishes. Between each of these clefts is developed a rod of firm tissue, the "branchial arch," and there are thus a series of arches meeting in the middle line, and enclosing between their adjacent edges oval clefts. It is unnecessary to describe here more fully the subsequent development of these parts, but we must note that long before the end of fœtal life all the branchial clefts are again closed, with the exception of the first, which remains as the external auditory meatus, tympanic cavity, and Eustachian tube.

But in some cases one of the lower clefts, usually the third or fourth, remains open, and we have thus produced a passage, leading from the outside of the body into the cavity of the pharynx, or a **pharyngeal fistula.** This fistula usually occurs below the glottis, and it may be recognised simply by introducing a probe, which will project in the pharynx, and can there be seen or felt. It gives rise not only to a disagreeable deformity, but may allow of the passage outwards of small quantities of food or of irritating secretions. The treatment of such a case consists in effecting closure of the fistula by such means as cauterisation of its interior, or by a slight plastic operation, consisting in freshening the edges, and securing over the orifice a small flap dissected from the adjacent skin.

Hare-lip and cleft palate.—*The development of the first branchial arch* is, however, of far greater interest and importance to the practical surgeon. This arch, which develops largely into bone, lies anterior to the auditory meatus (the remnant of the first cleft). It divides near its root into two parts, an anterior (superior) and posterior (inferior). The two posterior processes unite in the middle line, and in each is developed one half of the lower jaw, with the adjacent soft tissues. The superior or anterior process also projects inwards, and is destined to form the superior maxilla and adjacent parts, the lip, hard and soft palates, etc. Hence, between the superior and inferior processes of the first branchial arch we have the mouth. The superior processes, however, differ from the inferior in that they do not, in front, at any rate, unite in the middle line. Between them is developed downwards from the base of the skull a projection known as the "frontal process." From this frontal process are formed the vomer, the triangular cartilage of the nose, the intermaxillary (or premaxillary) bones of the lower animals, or their equivalents in man, and the central portion of the upper lip which corresponds to these bones.

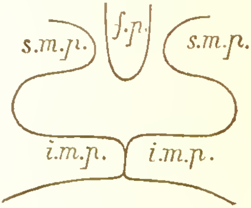

Fig 2.

In man the intermaxillary bone is represented by that portion of the superior maxilla which carries the incisor teeth. Hence, at an early stage of development (the sixth week) the parts of the face lying above the mouth are arranged as in Fig. 2, which is purely diagrammatic. In the middle line above we have descending the frontal process (*f. p.*) and on either side the superior maxillary processes (*s. m. p.*) of the first branchial arch. Between each superior maxillary process and the frontal process is a deep groove, the "orbital groove," running towards the orbit. The irregular cavity lying between these processes and the united inferior maxillary processes (*i. m. p.*) (the lower jaw) is to form the mouth, nose, and nasal ducts. As development proceeds the superior maxillary processes come into contact and then unite with the frontal process anteriorly, while behind they pass posteriorly to the frontal process, and unite with one another. Thus they entirely shut off the cavity of the mouth below, while above they leave, on either side of the frontal process an irregular cavity, which, by the subsequent ingrowth of the surrounding parts, is converted into the nasal cavity and nasal duct of its own side. Thus eventually we have three cavities, viz. that of the mouth and the two sides of the nose. The union of the superior maxillary processes, to form the median raphe of the palate, occurs about the ninth week of fœtal life.

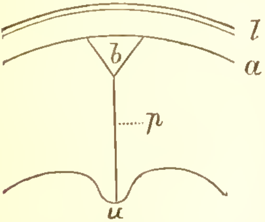

Fig. 3.

l, Lip; *a*, alveolus; *b*, intermaxillary bone; *p*, raphe of palate; *u*, uvula.

Such is the normal development of the superior maxillary bones, the palate (which is the posterior part of the superior maxillary processes), the nasal septum, and the lips. But in certain cases the development is imperfect, owing to the fact that the parts have never coalesced. If, as often happens, the superior maxillary process of one side fail to unite with the frontal process, there results a cleft between the corresponding parts in the child, that is, between the intermaxillary bone with its section of the lip on the one hand, and the rest of the alveolus with the lateral portion of the lip on the other. In other words, we have a simple *hare-lip.* If the want of union exists farther backwards along the line where the two superior maxillary processes should unite (the raphe of the palate), we have *cleft palate.* Again, both superior maxillary processes may fail to unite with the frontal process, in which case we have a *double hare-lip ;* and we may have either single or double hare-lip combined with cleft palate. It is obvious, therefore, that in all cases of cleft palate, behind the intermaxillary bones, the fissure will occupy the middle line, that is, it will lie between the superior maxillary processes of the fœtus. But where the cleft is in the alveolus or the lip, it will no longer occupy the middle line, which is filled up by the frontal process, but will pass off to one or both sides, so as to lie between the frontal process and the corresponding superior maxillary process. These various conditions may be represented diagrammatically by the accompanying sketches of the roof of the mouth looked at from below (Figs. 3 and 4).

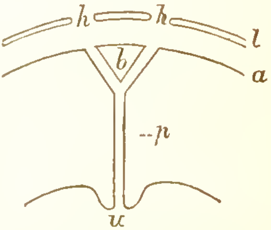

Fig. 4. — Double Hare-lip (*hh*) and cleft Palate (*p*). *l*, Lip ; *a*, alveolus ; *u*, uvula.

The following varieties of these deformities are met with in actual practice :

1. Simple hare-lip, an incomplete union of the superior maxillary process and frontal process. *Cheilo-gnathus.*

2. Double hare-lip, where the non-union is bilateral.

3. Fissure of the lip and alveolus on one side, where the non-union is more extensive than in No. 1.

4. The same on both sides.

5. Fissure of the hard and soft palates behind the alveolus. *Palato-gnathus.*

6. Fissure of the hard palate only, which is very rare.

7. Fissure of the soft palate only (including the uvula).

8. Bifid uvula.

9. Cleft palate, combined with fissure of the lip and alveolus on one or both sides. *Cheilo-palato-gnathus.*

Of these various forms and combinations several will have to be considered in detail.

The *origin* of these deformities is unknown. It is now generally believed that they are due, as above stated, to failure of development, and not, as was formerly held, to intra-uterine inflammation or other disease. It is probable that they are owing to some fœtal affection occurring before the ninth week of pregnancy, as after that time the parts are united. Sometimes there is presumptive evidence of the mother having received a mental shock during pregnancy, and such has been assigned as the cause of the deformity; but we must accept such superstitious evidence with reserve, both because mothers are very apt to imagine some explanation of the phenomenon, and because many people are so much in the habit of receiving severe shocks, that it would be difficult to find any period of nine months in which they had been free from them. In some cases other deformities coexist. It may affect more than one member of a family, as in an interesting case mentioned by Cooper Forster, but no distinct hereditary tendency has been traced.

HARE-LIP.

As stated above, this affection may occur on one side only, or on both; it is much more common on the left than on the right side (in the proportion of 63 to 34 per cent. according to Bryant's statistics, or of 113 to 52 according to Kölliker). The cleft presents certain varieties. Its edges may be placed very obliquely, leaving a wide, much rounded angle; or the re-entering angle may be much more acute, in which case the cleft is deep and narrow. The apex of the angle is towards the external nares, to which it approximates more or less closely. The nose itself is flattened to a greater or less extent, according to the width of the cleft and the separation of its edges, and this flattening increases with age if the cleft be not closed by operation at an early period. When both sides are affected there may be between the two clefts a central projection of the lip of almost normal depth, or this portion may be very slightly developed, or it may be carried forwards as an appendage to the tip of the nose. All of these points will influence the details of the operation for removal of the deformity.

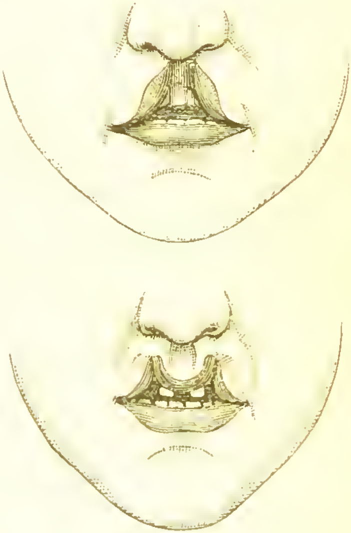

Fig. 5. Single and Double Hare-lip.

Beyond its unsightly appearance, the only trouble resulting from hare-lip is that it renders the infant incapable of sucking, and hence necessitates feeding by hand, with its concomitant annoyances and risks.

In all cases the affection should be remedied by operative treatment, as there is no tendency to natural cure. Operation should not be too long delayed. In time the efforts of the child to talk will increase the deformity, and the older the patient the greater will be the difficulty in obtaining the quietude necessary for closure of the fissure. Hence the period usually chosen is from the third to the sixth month, or even earlier, before the troubles of teething have commenced, and after the infant has acquired its first "hold upon life." It is important, before anything be done, to ascertain that the child is in good health, and that it is steadily increasing in weight, while with hospital cases it is well that its vitality should not be depressed by too long residence before or after operation. Precautions of a general nature are the more necessary, as infants bear shock and hæmorrhage very badly, and nutrition will have been previously defective.

The operation.—The principles upon which the operation is conducted are as follows: 1. The edges of the cleft must be freshened to allow of their union when apposed. 2. All tension must be taken off the parts by freeing the lip well from its deep attachments, and, if necessary, by approximating the alæ nasi. 3. The edges must, when placed in position, be so arranged that there is no interruption to the continuity of the red line of the lip. 4. During the process of healing the edges must be held in firm apposition. In all cases union of the edges by first intention is aimed at, and if this fail the surgeon must wait until the wound has healed and then operate again, union by granulation rarely occurring. Bearing these general principles in mind, the student will find less difficulty in appreciating the steps of the operation, as well as the modifications which are required in some cases, or which have been suggested from time to time.

In an ordinary case the following procedure is to be adopted. The child having been chloroformed, and the head firmly held in a convenient position, in a good light, a pair of forceps is placed on either side of the cleft so as to compress the lip with the superior coronary artery. The edges of the cleft are then pared by transfixing with a small-bladed knife and cutting away a thin strip. These strips may either be removed, or, if the cleft be a wide one, turned down in various ways, to be used in filling up the hiatus. In all cases we must go through the entire thickness of the lip and cut right up to the angle of the cleft. It is well, in paring the edges, to make the cuts concave towards the middle line, so that when the surfaces are brought together the line of union will be extended and will prevent the formation of a dimple in the lip.

The deep attachments of the lip to the jaw may now be divided, so as to remove all tension, and there is often pretty free hæmorrhage from this proceeding. The edges of the cleft are then brought carefully into apposition, the red line of the lip being maintained. They are thus held either by one or two hare-lip pins, or by sutures, preferably of silver wire. Whichever method be adopted, the pins or sutures must be placed deeply, so as to underlie and compress the coronary artery, but must not invert the mucous membrane behind. If pins be used, they are fixed, and the parts steadied by a figure of 8 suture passed several times round their projecting ends. More complete accuracy of position is then secured by as many fine sutures of silver, silk, or "silkworm gut," as may appear requisite. I prefer also to insert a few fine sutures on the inner mucous surface, for which purpose the lip is inverted by traction upon the lowest of the outer sutures. The compressing forceps can now be removed, and the sutures and mutual apposition of the edges will prevent hæmorrhage. A piece of strapping is carried across the lip from cheek to cheek, the cheeks being first pinched together to take off all traction. Only in very exceptional cases is it necessary to adopt such means as Hainsby's truss for approximating the two sides (Fig. 6). If the nose be much flattened, the ala should be freed from its deep attachments along with the lip in the second stage of the operation.

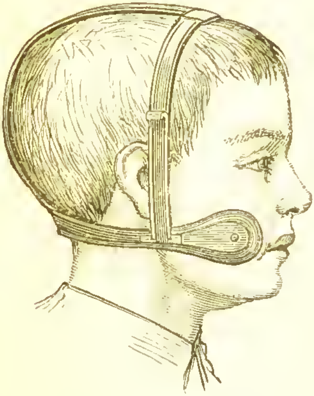
Fig. 6.—Hainsby's Truss.

In the after-treatment care must be taken to avoid too extensive opening of the mouth during feeding, which can now be carried on by suction. When the wound is to be examined the strapping is removed, and during the process the cheeks are pinched together. It is well to place a small piece of lint, so as to prevent adhesion of the strapping, over the wound itself. If pins be used they should not be retained longer than seventy-two hours, or suppuration will occur along their track, leaving a scar. Sutures may be left rather longer. All sutures should be removed within four days, or earlier if they appear to be unnecessary, or to be causing irritation. The ligature which was placed over the pin, and which becomes encrusted with blood, should not be disturbed, as it tends to hold the parts together. Strapping may be retained until complete union has occurred, which will be in about fourteen days.

In cases of *double hare-lip* precisely the same method is adopted, both clefts being treated at once, and pins may be driven right through the flaps, so that the same pin holds both sides and the central portion. Owing to the frequent shortness of the central portion, it is often necessary to turn down the strips taken from the lateral portions and unite them in the middle line, beneath the central lobule, thus obtaining more tissue. In other cases, again, the nose is much flattened, and there is no columnella. It will then be necessary to use the central portion of the lip in order to make a columnella, the two lateral portions being brought together in the middle line beneath it.

The operation may fail, owing to the occurrence of suppuration, or to want of healing power, and consequent non-union, and in either case may be repeated when the child has fully recovered. Sometimes the shock and inevitable loss of blood tell upon the infant's constitution, and cause great weakness and wasting, or even death from exhaustion.

Hare-lip complicated by protrusion of the intermaxillary bones.—In many cases of double hare-lip the alveolus is also doubly cleft, and the united intermaxillary bones, with their corresponding portion of the lip, project forwards, being attached to the end of the vomer, which may undergo some hypertrophy. In these cases, before the ordinary operation can be proceeded with, it is necessary to reduce the protrusion. As a rule this can be done by pushing it back through main force; but if the vomer be much elongated it may be well to remove a wedge of bone from behind the intermaxillary portion; or, if the central lobule be small, and situated near the tip of the nose, it may with advantage be removed altogether, as, even if it be replaced, the result will be that the incisor teeth will grow directly backwards into the mouth. The operation may then be performed for hare-lip as usual, or it may be deferred for a short period, the prominence being meanwhile held back by a piece of strapping until it has acquired new connections. It is unnecessary to operate upon the alveolar portion, as the edges of the cleft are thus brought into close apposition, and even if they do not unite no harm will result.

CLEFT PALATE.

As already stated, this may affect the uvula only, or the soft palate, or the hard palate, or both. *Bifid uvula* is an affection of no practical importance, save that in some cases it causes a slight defect in speech. In such a case it may be cured by paring the edges of the cleft, and uniting the freshened surfaces with fine sutures.

Cleft of the soft palate interferes with the proper closure of the posterior nares during deglutition and speaking, and is consequently of greater clinical importance. During infancy it gives rise to trouble, by allowing the regurgitation of food through the nose, and necessitates feeding the child by means of a spoon with small quantities of fluid at a time. When the child learns to speak there is noticed a peculiar nasal twang, and difficulty in articulating those sounds which are produced at the back of the mouth. To some extent nature will overcome these difficulties by the great development of the levatores palati, which draw upwards the two sides of the velum, while the upper fibres of the superior constrictor of the pharynx draw forward the posterior surface of that cavity, and thus aid in shutting off its upper portion. This closure may, but often does not, become complete, and the vocal difficulty is never overcome.

Cleft of the hard palate intensifies the difficulties of deglutition and speech. The cavity of the mouth is thrown directly into that of the nose, and food will readily pass upwards and be regurgitated, while the high roof of the mouth and nasal communication impart to the speech a characteristic twang, and render articulation very imperfect. There are two forms of this affection: in one, the rarer, the vomer has its lower border free, and the two sides of the palate are also free, so that both sides of the nose communicate with the mouth. In the other form the vomer is attached to one side of the palate, shutting off from the mouth the nasal cavity of that side, while on the other side the palatine edge is free as before. In all cases the roof of the mouth is high, which aids the surgeon greatly in the operative treatment.

Cleft palate is only of danger to life or health in the infant in whom treatment is impossible; and as in the adult it is solely of importance from the difficulty in speech which it occasions, all operations for its relief must be classed as "operations of expediency;" and hence some surgeons hold, that for such a complaint we are not justified in submitting the patient to even the slight risk involved in an operation which, moreover, may prove a failure. With this view various ingenious contrivances have been invented, having for their object the mechanical closure of the orifice. A detailed description of these would here be out of place, and the reader may be referred to the article by Mr. Salter, in Holmes's "System of Surgery."* The principle of such appliances is in all cases a firm "obturator" attached to the hard palate, with or without a flexible curtain for the velum.

In most cases, however, parents and surgeons will prefer the slight risk of an operation, which, if successful, constitutes an absolute and permanent cure, and which relieves the patient from the expense and embarrassment of an artificial palate. With very broad clefts only is operation impracticable, as in such a condition the tension on the flaps would be too great for their union.

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* Vol. ii., p. 184. 3rd ed.

In choosing the *time* for such an operation there are two contingencies to be avoided. If it be done at too early an age the child suffers severely from shock and loss of blood, the parts are very small and difficult to manipulate, and it is impossible to obtain the perfect quiescence necessary for union. If too long delayed the patient will have acquired a peculiarity of speech difficult or impossible to overcome. Hence the age usually chosen is about the third or fourth year, when the period of infancy is passed, and speech is not yet fully developed.

The operations required for the hard and for the soft palates respectively are essentially different, and must be considered apart. If only one division of the palate be cleft, that must be united; if both, the two operations may be performed at one time, or either may be done first, the parts being allowed to heal before the second operation is commenced. Chloroform should always be given, as the risk of hæmorrhage into the trachea is, with careful assistance, very slight, and the advantage of a quiet patient is inestimable. The head must be well raised and in a good light. Smith's or some other form of gag is used to keep the mouth open (Fig. 7). It has been proposed to operate with the patient's head hanging so far back as to occupy an inverted position. The surgeon will

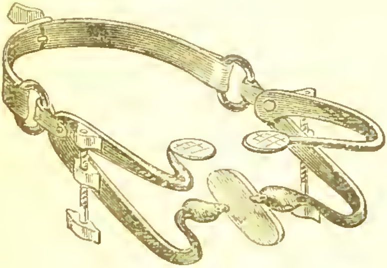
Fig. 7.—Smith's Gag.

then look directly down upon the palate, and blood will run into the nares rather than down the trachea.

Urano-plasty.—In the operation upon the hard palate (*urano-plasty*) two muco-periosteal flaps derived from the sides of the palate are brought together in the middle line. On each side of the cleft, just within the alveolar ridge, an incision is made along the palate, completely down to the bone, and extending slightly on to the soft palate. The edges of the cleft are then completely pared by a sharp two-edged knife. By means of a specially-shaped raspatory the strips of soft tissue between the lateral incisions and the cleft are now elevated from the bone, remaining attached at their ends only. If they are firmly held at the posterior part along the junction of the hard and soft palates, a pair of curved scissors may be introduced beneath the mucous membrane to divide the adhesions. It now only remains to unite these two flaps in the middle line by silver sutures, which may be left *in situ* for ten days or a fortnight. The edges of the flaps will unite, and the patch from which the muco-periosteal flap was withdrawn heals by granulation. A modification of this operation, introduced by Sir Wm. Fergusson, consisted in dividing the palatal process of bone with a chisel, after having made the lateral incision; but this appears to me a quite unnecessary complication, and may be followed by necrosis of the bone.

Hæmorrhage during the operation may be controlled by digital pressure on the anterior palatine foramina behind the incisor teeth, or the posterior palatine foramina, which may be felt about half-an-inch anterior to the hamular process, and internally to the last molar tooth. In cases of secondary hæmorrhage these apertures have been successfully plugged with wooden spicules, generally made from a common lucifer match.

Staphyloraphy.—The operation for closure of the soft palate (*staphyloraphy*) is complicated by the necessity of avoiding muscular traction. With the sharp two-edged knife the edges of the cleft are pared, care being taken, as in all plastic operations, to remove the strip entire, and to freshen properly the angle of the cleft.

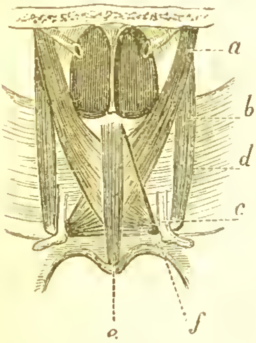

Fig. 8 —The Muscles of the Soft Palate, from behind.

a, Levator palati; *b*, tensor palati; *c*, hamular process; *d*, wall of pharynx; *e*, azygos uvulæ; *f*, the point of entry of the knife in Pollock's operation; above it is the line of incision made on withdrawing the knife. (From Treves' "Surgical Anatomy.")

The palate being then firmly held in the forceps, sutures are to be passed through both sides. A dexterous hand will pass a curved needle, in an ordinary holder, through both sides of the velum, just as in suturing any other wound; but special contrivances, of various sorts, have been devised to facilitate the process. The simplest of these is, perhaps, a straight needle, in a handle, with the eye at the point; by means of this a silver suture is passed through one side of the cleft and the needle withdrawn; the needle is then passed through the other side of the palate, and is there threaded with the posterior end of the suture; on again withdrawing it, the suture is carried through both sides. Silver sutures are probably the best for this purpose, fine silk being used for the uvula, or small intervals; others prefer "silkworm gut." The edges being brought together, it remains to take off muscular tension. Pollock's method of doing this is to enter a knife, with its point held inwards and downwards, on the inner side of the hamular process, which is readily felt in the mouth, and then by carrying the handle of the knife downwards, to sweep the blade through the levator palati (Fig. 8). Fergusson divided the levator palati from behind, before suturing the cleft, by a knife bent at a right angle on the flat, then snipping with scissors the anterior and posterior pillars of the fauces. I prefer the former method, as being easier of performance. Sutures may be retained about ten days, and soft or fluid food only should be given, the patient being restrained from speaking. In the case of young children, it is well to train them not to speak for several days before the operation is performed.

In either of the above operations, should the parts fail to unite, the surgeon may, after a time, repeat the procedure ; if only foramina are left, these will often, in time, contract considerably, or close entirely ; or, if large, their edges may, after a time, be pared and re-united. In all cases it is necessary, after the clefts have been closed and the parts healed, to teach the patient to speak properly ; and there may be difficulty in overcoming the peculiar articulation, but with care and patience, and if the operation has not been too long delayed, this may, in time, be accomplished very successfully.

Of the **remaining deformities** of the mouth, none approach in frequency, or in clinical importance, to hare-lip and cleft palate.

In cases of extreme rarity there has been seen *median cleft* of the upper lip, and in some of these the intermaxillary bone is absent. Fissure may also occur between the central and lateral incisor. Median fissure of the lower lip is also very rare. Sometimes a cleft extends from the angle of the mouth towards the external angle of the palpebral fissure. In other cases, the division of the superior and inferior maxillary process extends too far backwards, and a cleft in the cheek is formed extending directly outwards from the mouth, or *macrostoma*. All of these clefts may be treated upon the principles already enunciated.

Absence of the lips (*achelia*), congenital closure of the lips (*synchelia*, or *atresia oris*), partial closure of the lips (*microstoma*), and imperfect development of the lips (*microchelia*), are curiosities, all being extremely rare, and often combined with other forms of monstrosity.

Macrochelia, or enlargement of the lip, is of more importance. When congenital, it may be combined with macroglossia, or hygroma of the neck, and, pathologically, it consists in a dilatation of the lymphatics and lymphatic spaces, which everywhere pervade the tissue of the lip. Accompanying this dilatation, and as a result, no doubt, of the excessive nutrition, there is some true hypertrophy of the tissues. Treatment is not satisfactory, but attempts have been made to excise portions of the lip. In strumous children, some enlargement of the lips is very common, and appears to be due to an inflammatory process of low and chronic type. It is seldom serious in itself, and is to be met by anti-scrofulous treatment, which will probably be indicated for other graver affections. A similar thickening is sometimes seen in the subjects of syphilis, congenital or acquired.

Absence of the tongue (*aglossia*) has been met with in only one case, that of Jussieu. Small tongue (*microglossia*), and cleft of the tongue (*diglossia*) are very rare. In some cases the tongue appears to be well formed, but not to have arisen from the floor of the mouth, with which its mucous membrane is everywhere continuous (Barker).

Macroglossia, or large tongue, may be accompanied by macrochelia or hygroma. In some cases it is said to be due to hypertrophy of the fibrous or of the muscular tissue, but by far more commonly it is, like macrochelia, an affection of the lymphatics. We find, on section of the tongue, dilated lymphatic spaces, lined with endothelial cells, forming sometimes cysts, sometimes elongated canals. The probability is that this dilatation is due tc obstruction in some part of the lymphatic system, and pathologically the condition is assimilated to that of elephantiasis. But the enlargement thus resulting causes, and is intensified by, inflammatory changes. It is usually developed in early life, and many authors regard it as always congenital, although a case mentioned by Butlin, in a patient, thirty years of age, would seem to show that it may arise in after life. The tongue is, at first, merely slightly enlarged; it then presses upon and is irritated by the teeth; as it grows it may project from the mouth, where it is very liable to irritation and consequent inflammatory attacks, and where, by constant pressure, it may even cause deformity of the lower jaw. It now seriously impedes deglutition and respiration, and if not relieved may cause death from suffocation, during an inflammatory increment of the swelling.

The *treatment* consists, at first, in endeavouring to exercise pressure by various means, as by feeding the child with a large teat, or by keeping the lower jaw closed with a bandage, which has at least the advantage of retaining the tongue within the mouth and thus protecting it from irritation. If the organ increase in size, we may remove a V-shaped portion from its tip, bringing the sides together, or may excise more or less of the mass. In some cases the affection is apparently connected with a strumous condition, and here such remedies as cod-liver oil may prove of service.

Tongue-tie is the result of a short frænum linguæ, which prevents the apex of the tongue from being raised, and thus impairs speech. It is a very common and easily-remedied deformity; but many cases which are subjected to operation would probably do equally well without. With a pair of scissors the edge of the frænum is slightly nipped, the cut being made as close to the floor of the mouth as possible, and the points of the scissors held down to avoid the ranine vessels. A slight cut having been made, the operation is completed by tearing. The parts may reunite if neglected, but the same procedure can readily be repeated.

In some instances the frænum has been too long, and the tongue has slipped back over the larnyx, causing death by suffocation. Similar instances of "tongue swallowing" have been noticed after division of the frænum.

The chief deformities of the *palate* and *pharynx* have been mentioned above. In some cases the uvula, or less often the entire velum palati, have been absent.

Congenital closure of the pharynx, or blind pharynx, is very rare, and a child so affected would be non-viable.

II. INJURIES.

Injuries of the mouth and pharynx present few peculiarities. It is to be remembered that these parts are very vascular, and hence that there is apt to be severe hæmorrhage, or great irritation and swelling, as the results of injury. But, on the other hand, this vascularity renders repair very easy and rapid, and the most serious wounds of this region will often heal up in a marvellous manner.

Hæmorrhage may be counteracted by the application of cold to the part (by sucking ice if in the mouth or pharynx), by local pressure, and by pressure upon the supplying arteries. In the case of the lips, a "bull dog" forceps will effectually compress the coronary artery, or the facial may be secured as it passes over the lower jaw. The position of the palatine arteries has been mentioned above (page 39). In severe hæmorrhage from the tongue it may become necessary to secure one or both lingual arteries, but, as a rule, it is possible to reach any bleeding point from the mouth. Heath's method of temporarily arresting hæmorrhage from the tongue is invaluable. It consists simply in passing two fingers over the dorsum of the tongue into the pharynx, and then hooking up the base of the tongue so as to compress it against the lower jaw.

When *sutures* are required within the mouth it is well to use silver, as materials which have to be tied are liable to become loosened when subject to moisture and constant movement.

In the case of cuts of the lip, flexile collodion is a valuable auxiliary means of retaining the parts in position, and acts at the same time as a protective covering. It should be applied along with a little finely teased cotton wool so as to form a firm crust.

Wounds within the mouth are very apt to become foul, which may be obviated by using antiseptic washes, of which Condy's fluid is one of the most useful. But a better method is to dust the part occasionally with iodoform, or to plug the wound and its neighbourhood with iodoform gauze; or, the part being first dried, we may paint it with an ethereal solution of iodoform and flexile collodion. Wound of a salivary duct may give rise to subsequent trouble from the formation of a salivary fistula (page 57).

Foreign bodies have not unfrequently been found lodged in the tongue, such substances as grains of corn, bullets, etc., being there met with. They cause much irritation and swelling, which may seriously obstruct respiration and feeding, or, if long retained, they may become surrounded by a hard mass of inflammatory tissue, not easy to distinguish from a tumour or chronic abscess. The treatment consists in removal of the foreign body, the accompanying glossitis being treated as described below.

The pharynx, constituting, as it does, the entrance to the alimentary canal, and with its irregular surface, is liable to the impaction of foreign bodies. As a rule, it is some article of food, as a fish bone or a crust of bread, which becomes here impacted. A large substance, as a piece of meat or bread, a cast of false teeth, etc., may block the lower part of the pharynx, and, pressing upon the larynx, cause suffocation. In such cases an attempt should be made to withdraw or push down the substance, according to its size and nature; and, if this cannot be done, tracheotomy may be necessary to render respiration possible until further measures can be taken. A favourite seat for the lodgment of small bodies, such as fish bones, is just external to the tonsil, where the pharynx forms a slight pouch. In all such cases there is much pain and irritation, and the foreign body should be removed as soon as possible. Forceps of various curves are used for this purpose, and in some situations which cannot be explored with the finger it may be necessary to examine with the laryngoscope in order to detect the foreign body. The surgeon must remember that the scratching and irritation cause the sensation of a foreign body to remain for some time after its removal, and hence, when the patient applies for advice, the cure may have already effected itself.

III. AFFECTIONS OF THE LIPS.

One of the most common diseases of the lips is slight *inflammation*, due usually to cold, and resulting in "cracked lips." The surface is exposed to cold and moisture, the epithelium is cast off, or dries into a crust which peels off, or is cracked upon movement, when there results a slight but painful fissure, which, if neglected, may become steadily deeper, causing serious and prolonged irritation.

The treatment consists in avoiding cold, and smearing the part with vaseline, ung. zinci, or some form of "lip salve," care being taken not to remove the epithelial crusts. Persons subject to this affection should, on the first commencement of dryness, apply vaseline nightly.

In children the subjects of *congenital syphilis*, a similar affection is very common at the angles of the mouth, and causes cicatrices which persist throughout life. More severe inflammation results from blows, insect bites, and, in strumous children, from various slight causes. It must be treated by cold, painting with collodion to constrict the vessels; or if of strumous or syphilitic origin, by the usual constitutional measures.

Herpes often affects the lips, and is frequently combined with pneumonia. *Lupus* is also here met with. These affections present no special characters. *Chancre* of the lip is not very uncommon, and may be due to direct inoculation, to conveyance of the virus by the fingers, etc., or, in the case of infants, to infection from the breast of a wet nurse. The only point of importance is not to mistake it for epithelioma, its appearances and treatment being those of chancre elsewhere. Other syphilitic affections are described below.

Nævus (angeioma) and *papillomata* of the lips are not unfrequent, but present no special characters.

Cysts of this region are common, owing to blocking of some of the numerous follicles on the inner surface of the lip; they become distended with their watery secretion, and may attain a large size. Their nature is, as a rule, easily made out, there being a tense, shining, soft swelling, which, if large, will give the sense of fluctuation. A free incision should be made, and if this does not cure, may be repeated, the base being touched with nitric acid.

More important is **epithelioma of the lip.** This affection is by no means uncommon, and its frequency is probably largely on the increase. (A general account of epithelioma or epithelial carcinoma will be found in the article on Tumours in vol. i.) It is almost always met with in the male, and in most cases the patient has been a constant smoker, usually of clay pipes; or some other habitual irritation may be traced. The usual seat of the growth is the lower lip, but the upper is sometimes affected. If not interfered with the result is certain; the submaxillary and cervical glands become affected, and the patient eventually dies from exhaustion, pain, or hæmorrhage, with or without visceral dissemination. It is not uncommon for epithelioma of the lip to cause at the commencement so little inconvenience that it is almost overlooked. As a rule epithelioma begins either as a small hard nodule, which soon ulcerates upon its surface; or the first appearance may be an intractable fissure or ulcer, which acquires a hard infiltrated base and margin, and grows steadily. In either case there is a hard, well-defined mass, with an ulcerated surface, the ulcer being shallow, unhealthy-looking, with elevated edges, irregular base, and fœtid sanious discharge. Pain is not a very marked symptom in the early stages, but contact with food, especially food of an irritating nature, causes pain. It is of the utmost importance not to mistake this affection for chancre, or, as is more probable, to treat chancre as an epithelioma. The following points will afford some guide in the diagnosis :

Chancre.	Epithelioma.
Usually in the female.	Usually in the male.
At all ages.	After forty years of age.
Commences as an ulcer.	May commence as a nodule.
Duration of a few weeks.	Duration indefinite.
Soon attains its maximum size.	Grows slowly, but steadily.
The cervical glands soon enlarge.	The glands enlarge later.
Secondary symptoms ensue.	Secondary symptoms absent.
May be febrile disturbance.	No fever.
No "cancerous cachexia."	In old cases may be marked cachexia.
Improves under treatment.	Does not improve.

It may also be possible to identify, in a scraping of the growth, cell nests, or other evidences of epithelioma. If there be evidence of visceral cancer the diagnosis is beyond doubt, but is too late to be of service to the patient.

There is but one principle for the *treatment* of epithelioma. If there be dissemination, we can only palliate symptoms. But if the disease be localised we should at once remove it, taking away also any enlarged or hardened glands. In most cases removal is effected by a simple V-shaped incision, with its apex downwards, cutting quite clear of the tumour, the parts affected being freely removed ; the edges of the incision are brought together, and allowed to unite as in the operation for hare-lip. When the gap thus left is very wide, it may be necessary to relieve the tension on its two sides by prolonging beneath the jaw two diverging cuts from the apex of the part removed, or by some other form of "cheilo-plastic" operation. In some cases the lower jaw will be found to be affected, and if so, the part must be removed.

After removal of a localised epithelioma of the lip the prognosis is better than in the case of most other operations for cancer. The early diagnosis and the comparatively isolated situation of the part contribute mainly to this result. In some cases there is no recurrence, in others it is long postponed. When recurrence does occur it is usually in the cervical glands, but may be at the site of the operation, owing probably to imperfect removal of the original growth.

IV. AFFECTIONS OF THE MOUTH.

In order to avoid repetition, there are included under this section many affections of the tongue, palate, and inner surface of the lips, which are common to those parts and to the rest of the buccal cavity.

Inflammation ; stomatitis. — Slight inflammation of the mouth is an exceedingly common affection. It may arise from the use of too hot food, of strong condiments, tobacco smoke, and other chemical irritants. Or it may be due to mechanical irritation, as from the edges of broken or carious teeth. It occurs also in most fevers and severe diseases, and frequently accompanies chronic wasting disease. More especially is it found in cases where the digestive organs are affected, and the "state of the tongue," *i.e.* the presence or absence and degree of catarrh, furnish the physician with a valuable guide in most cases of disease. Slight stomatitis is characterised by increase of secretion, which forms a clammy, perhaps fœtid, slime, and sometimes by salivation. The mucous membrane may or may not betray a tenderness on contact of hot food, etc.

The *treatment* consists in frequent rinsing of the mouth, with the use of some soothing lotion as borax (without glycerine), or carbonate of soda, or when less acute, of chlorate of potash. Very frequently there are also small vesicles or ulcers (" dyspeptic ulcers ") which usually heal readily upon using chloride of potash lotion, but their disappearance is hastened by the application of a little solid nitrate of silver.

More severe inflammation results from contact with the corrosive poisons, from injuries, and, in unhealthy persons, from any of the above causes. In these cases there may be much swelling, intense pain, and a purulent secretion; gangrene may supervene; and the general constitutional symptoms of inflammation are developed. Under such circumstances the usual methods of treatment of severe inflammations are to be adopted. The patient must have ice to suck; diluted lotions of borax, alum, etc., are used; food must be fluid and bland, and stimulants may be required, but should be well diluted. Great swelling necessitates scarification or deep incisions.

In addition to the above there are various specific inflammations of the mouth.

Thrush and aphthous inflammations occur mainly in infants or very debilitated persons. Here, in addition to a diffused general stomatitis, is to be noted the formation of ulcerating patches of varying size, usually superficial, and yielding readily to treatment. Not unfrequently these affections appear to be contagious in children, and they are often found in public nurseries. In thrush there is a special mycelial fungus; the "oidium albicans" and the "oidium lactis" are often found at the same time affecting the nipple of the nurse. Thrush is usually connected with the use of acid milk, and the saliva of the child is found to be acid. Treatment must be directed to improving the general health, with the means above described as available for stomatitis, care being taken that the milk is pure and not decomposed. In thrush, antiseptic washes, as Condy's fluid, dilute carbolic acid, or sulphurous acid lotions, etc., are valuable, and alkaline solutions should be used for washing the mouth.

Foot and mouth disease may affect human beings, being due usually to inoculation from the teats or drinking the milk of diseased cows. In this case we have small vesicles, which may develop into pustules, affecting the fingers, mouth, and nipple, together with slight fever. As a rule, the disease soon subsides under healthy conditions, but the pustules may be followed by gangrene.

In the *exanthemata*, inflammation of the mouth is common, and in *small-pox* well-marked pustules may occur on the tongue. *Diphtheria* may also affect this as any other mucous membrane. *Tubercle*, *lepra*, and *lupus* of the mouth and tongue are rare, and present no special characters; their importance is mainly from a diagnostic point of view, and the diagnosis hinges mainly on the conjoined affection of other parts or organs.

Scurvy is now rarely seen in this country. The symptoms as regards the mouth are those of a severe stomatitis, accompanied often by gangrene, dropping out of the teeth, or necrosis of the jaw. The general treatment of scurvy is indicated, together with the palliative treatment of stomatitis.

Mercurial stomatitis is of importance, owing to the free use of mercury in medicine and in the arts. The affection is of very varying degrees of severity, but presents the symptoms above described as those of stomatitis. In order to avoid these unpleasant symptoms, patients who are taking mercury should carefully cleanse the teeth and wash out the mouth several times daily. If symptoms appear the mercury should at once be stopped, if given as a drug, and the occupation should be given up if it necessitates exposure to mercury. In these cases care must be taken not to give iodide of potash, as by increasing the elimination of mercury it temporarily increases salivation.

Some other drugs besides mercury, as, for instance, iodine, may cause salivation. In cases where *lead* has been steadily introduced into the system, we find the well-known "blue line" on the gum, due probably to sulphuretted hydrogen evolved from decaying teeth acting upon lead salts in the blood-vessels, with formation of the insoluble sulphide. *Copper* is said to yield a similar "green line;" but as the sulphide of copper is brown, it must be of a different nature.

Syphilitic affections of the mouth are common and important. *Chancre* may occur in various parts, usually on the lip and tonsil. It is usually found in the female, and resembles chancre in any other region. Care must be taken not to mistake it for cancer, and the diagnosis may be made upon the lines indicated on page 49. Among the *secondary symptoms* of syphilis, those of the mouth are prominent. In the early period there is almost always general stomatitis accompanying the cutaneous roseola, and sore throat, *i.e.* catarrh of the fauces, is one of the most common manifestations. But in addition to this there are also, as a rule, "*mucous plaques.*" These are found at any time throughout the secondary period, but are more common later on. They are small patches, white in appearance, as if the part had been touched with nitrate of silver, and are due to a superficial inflammation, with fatty degeneration of the epithelium. They are infecting, and hence great care is necessary in cleaning all utensils, etc., used by the patient. They may be raised or depressed, and are usually surrounded by a zone of slight inflammation. They are usually seated on the lips, palate, base, or back of the tongue.

In addition to the constitutional treatment of syphilis, use must be made of washes of borax, alum, bicarbonate of soda (gr. xx ad ℥j), or chromic acid (gr. v ad ℥j). The frequent application of a saturated ethereal solution of salicylic acid is of value, and condylomata may be cut off

Equally common in secondary syphilis are inflammation and ulceration of the tonsils and soft palate, and the ulcers leave scars, which may cause deflection of the palate.

Tertiary syphilis affects mainly the tongue, and the lesions there produced will be described below, in speaking more in detail of that organ. A not infrequent condition is ulceration, probably due to gummatous deposit of the palate. Should this affect the hard palate, it may give rise to necrosis, and in both the hard and soft palates it frequently causes perforation, of which the most common seat is in the middle line, near the posterior part of the hard palate. Similar perforation may occur in hereditary syphilis. All such cases are treated by the usual constitutional measures. But when the destructive process has come to an end, if a foramen be left, this must be treated. An obturator should always be used for a time. This will relieve the symptoms (viz. defect of speech and regurgitation of food into the nose), while the opening will often close very considerably. A simple and efficacious obturator may be made of a piece of copy-book paper. But if all chance of further contraction of the orifice appears to have come to an end, the surgeon should operate as in the case of cleft palate.

Tumours of the mouth.—*Small papillomata* are not uncommon, and merely require cutting off, the base being cauterised with nitric acid; they may return once or twice, but rarely oftener. In older persons, however, there is a risk of their becoming epitheliomatous, and in a patient over thirty-five years of age the slightest sign of infiltration of the surrounding tissues, or persistent recurrence, should be the signal for immediate and free excision. *Nævus* sometimes affects the interior of the mouth. *Adenoma* of the soft palate is not very rare, and can usually be readily shelled out. Other benign tumours are rather of pathological than clinical interest. Malignant disease is not often primary in any part of the mouth but the tongue, tonsil, and lip, which are elsewhere considered, but it may extend from those situations to any part of the mouth.

Cysts are very common. Simple cysts of the lip were described in section III., and the same description will apply to the mucous cysts of any part of the mouth.

Ranula is a large cyst, having probably several pathological varieties. It is due to obstruction of the ducts of one of the glands, in the floor of the mouth, with consequent collection of secretion. The cavity thus produced is lined with a columnar epithelium, similar to that of the duct, and containing a watery fluid, with some albumin and mucus. In some cases, probably, it is Wharton's duct which is thus obstructed; in others one of the ducts of Rivinus; in others that of one of the smaller muciparous glands, especially of that known as the Blandin-Nuhn gland, situated immediately below the tongue (Recklinghausen). Very rarely a hydatid cyst has been found in the site of a ranula. Whatever be the pathological cause of the cyst, there will be on one side, rarely on both, of the frænum linguæ, in the floor of the mouth, a soft, elastic, painless tumour, which slowly and steadily increases in size. It has no tendency to diminish or to burst, and may become of great size, pressing downwards into the submental region, and obstructing the mouth. The diagnosis is simple enough, owing to the obviously fluid character of the contents, the uniform shape of the tumour, and the rarity of other growths in this situation. Puncture with an exploring needle will confirm it. In some cases tapping will suffice to effect a cure, but it is well to irritate the inner surface of the cyst by scratching it with the trocar, or by injecting some irritant fluid. If these means fail to cause its obliteration, the more prominent part of the cyst must be cut off and the cavity plugged, so that it may granulate from the bottom. Or a V-shaped piece of the mucous membrane covering its surface may be separated, turned into the cavity, and secured there by a suture.

Acute ranula has also been described. It appears to consist, in some cases, of a sudden obstruction of one of the ducts, with consequent collection of fluid behind it. In other cases it is said to be a hemi-glossitis, with much swelling of the floor of the mouth.

In the floor of the mouth, also, may be found a cyst due to enlargement of a bursa overlying the hyoid bone. Or a dermoid cyst may be found, either in the middle line, between the genio-hyo-glossi, or laterally, between the hyo-glossus and genio-hyo-glossus. Such cysts must, if not too large, be dissected out from the floor of the mouth, or from below the jaw.

In connection with ranula we may here refer to one or two other affections of the *salivary ducts*, the glands themselves being treated of in Art. XI., vol. ii.

Salivary calculus is not a very common affection, but may give rise to some trouble. It consists of a concretion of carbonate and phosphate of lime. Such a concretion may either remain embedded in the gland, in which case it will give no trouble; or it may be swept on through the duct and then discharged; or it may block the duct. In the latter case there is collection of the secretion behind the obstruction, which may cause a good deal of pain and some swelling of the corresponding gland, always increased by taking food. A salivary calculus may always be suspected when there are pain and swelling in one of the glands (unless, indeed, it is clearly a case of mumps, or secondary parotitis), and its presence can usually be ascertained by feeling with the finger from within the mouth, along the course of the ducts.

When pressed upon, the little mass may yield and pass onwards, or if it does not, may be cut out, when the affection will be cured. But if relief be not thus given, a good deal of irritation is set up, and may give rise to suppuration, with fistulous openings. I have seen a calculus in Wharton's duct, which had caused sinuses in the submaxillary region, mistaken for a case of necrosis of the lower jaw, the concretion feeling not unlike a small sequestrum. By bursting the duct, or by suppuration, the salivary calculus will probably eventually escape either inside or outside of the mouth, and there results a "salivary fistula." In all cases the treatment consists in removal of the obstruction as soon as it is detected, with treatment of the fistula if one has formed.

Salivary fistula, or abnormal opening of a salivary duct, may occur either inside or outside of the mouth. It may be due to the lodging of a calculus, with subsequent suppuration, or to blocking of the duct from inflammation, or, especially in the case of the parotid duct, to injury. If the fistula occur within the mouth, it is of no importance, inasmuch as the saliva reaches its proper destination. External salivary fistula is usually connected with the parotid duct. There is a small opening on the cheek over the course of the duct, from which comes away continually a small quantity of watery fluid. On mastication, the quantity of this fluid is much increased, and a teaspoonful may be collected in a few minutes. It will reduce starch to sugar, and gives the ferric chloride reaction of potassium sulphocyanide. A fine probe may be passed into the duct through the opening. The affection is more troublesome than serious; but as relief is easily given, it should not be withheld. If there be any removable cause of obstruction in the duct, as a calculus, it should be removed. If this cannot be done, or if, when done, it fails to allow the saliva to run freely into the mouth, we must make an artificial internal fistula. A probe is passed into the external opening, and its point carried along the duct and rendered prominent in the mouth as near to the original aperture as possible. This is then cut down upon from within, and a free opening made from the mouth into the duct, which opening is kept patent by a probe passed in daily for a short time. The external fistula has its edges touched with the cautery, and will soon heal up, after which the internal opening may be left to itself, and will form the permanent exit for the secretion.

V. AFFECTIONS OF THE TONGUE.

Atrophy of the tongue is not very rare, and is usually unilateral, being due to nerve lesions, as after section of the hypoglossal. It is generally followed by a compensatory hypertrophy of the opposite side, so that the size of the organ as a whole is little if at all altered, and the interference with speech is not great. The condition is of slight surgical interest.

Hypertrophy of the tongue is a sequel of various inflammatory processes, syphilitic and otherwise, and will therefore be mentioned again in describing these affections. Macroglossia is described with the deformities of the tongue.

Inflammation of the tongue may be acute or chronic, superficial or deep, simple or specific, and we have thus various conditions to describe. Simple acute inflammation of the mucous membrane only is a concomitant of catarrh of the rest of the mucous membrane of the mouth in stomatitis (*q.v.*).

Acute glossitis is an acute inflammation limited to the tongue, but affecting that organ more deeply than does stomatitis. It comes on rapidly, often with no very obvious cause; there is pain and swelling of the tongue, with salivation; the organ then becomes smooth, bright red, often very much swollen, so as to project beyond the teeth, and very painful, especially on contact of food or of the teeth. In many cases its origin has been attributed to catching cold, in other instances a similar affection arises from injury, as a blow, or an insect bite, etc. The affection is seldom dangerous, and will usually subside in a few days, but may occasionally give rise to sloughing and death from septic poisoning. The treatment consists in the administration of ice, the use of fluid and non irritating food, and the usual constitutional measures adopted in acute inflammation. Leeches may be applied under the jaw. In severe cases, with much swelling, rapid amelioriation is produced by incision of the tongue. For this purpose a sharp knife is introduced well back, and some two-thirds of an inch externally to the raphe, and then carried forwards with a bold sweep, so as to reach a depth of about half an inch. The relief thus produced is most rapid, the swelling going down and the pain subsiding, so that a patient who a few hours before appeared on the verge of asphyxia, may be quite comfortable and almost well.

Hemiglossitis is a similar affection attacking only one side of the tongue. Its characters differ in no other essential particular from those of glossitis, but the disagreeable symptoms are naturally less severe.

The above are examples of acute parenchymatous inflammations of the tongue. There is also a chronic parenchymatous inflammation in the form of *chronic abscess*. This is usually due to an old injury, or to the impaction of a foreign body. The abscess is deeply seated, and having thickened infiltrated walls, gives a solid feel when examined by the finger, which may cause it to be mistaken for a tumour.

It frequently gives rise to successive attacks of superficial inflammation. The diagnosis from a tumour can only be somewhat problematical, depending upon the duration, the existence of any known cause of inflammation, and the results of incision. The mass should be incised, the somewhat caseous pus cleared away, and the infiltrated walls scraped or cut away, after which the wound will usually heal readily.

Chronic superficial glossitis is an affection still involved in much obscurity, in spite of the attention which has of late been bestowed upon it. Under this name we include all the various forms known as leucoma, leucoplakia, psoriasis, ichthyosis, tylosis, and keratosis. In his recent work on "Diseases of the Tongue," Butlin describes "leucoma," with several varying forms, but separates "chronic superficial glossitis." In doing so, however, he admits that there is no essential difference between the affections thus designated, and adds, "The term chronic superficial glossitis might be applied with equal propriety to all these conditions of the tongue, for they are all due to chronic inflammation of its superficial structures." I here use the term in this extensive sense, because (1) there is no anatomical distinction between "leucoma" and "chronic superficial glossitis"; (2) leucoma is admitted to be an inflammation and *ipso facto* a glossitis; (3) the clinical distinctions which have been hitherto drawn stand on a very uncertain basis.

In one form chronic superficial glossitis is characterised by a general redness and smoothness of the tongue; the glazed red tongue. The surface is bright red, devoid of papillæ, and often very sensitive. There may be some swelling, and more acute inflammatory exacerbations often arise, each leaving the tongue worse than they found it. This condition is most intractable, and lasts for years; indeed, it is doubtful whether cure ever occurs. Whether this glazed red form of inflammation is or is not an antecedent of the form known as leucoma must still be regarded as doubtful. While Barker speaks clearly of a red inflammation preceding the white, Butlin states that he has not seen such a condition. I am inclined to think that the red stage is always antecedent; but the latent nature of the disease in its commencement renders the point difficult of investigation, inasmuch as it is seldom noticed. It appears to me, however, that the "red stage" is that of a typical superficial inflammation, and that in the "pale stage" there has ensued a fatty degeneration of the infiltrating cells, thus giving rise to the change of colour. Such change constantly occurs in inflammatory products, a closely similar case being that of atheroma, due to chronic endarteritis.

Leucoma, or leucoplakia, which I here regard as development of chronic superficial glossitis, is a well recognised affection of the mucous membrane of the tongue. It consists in the formation of a more or less extensive patch of whitish, greyish, blueish, or purplish colour, covering often a large part of the surface of the tongue. The surface thus affected is hard and dry, often distinctly stiff. Subjective symptoms are not as a rule marked, but there may be some pain, and attacks of inflammation are common. This condition is also very chronic, and probably incurable. It may partially heal for a time, usually to break out again, or may disappear at one point while extending at another. Not infrequently there is a similar affection of the inside of the cheeks, or some chronic skin disease.

In a more advanced stage leucoma gives rise to the condition which has been badly termed "psoriasis," where the patches increase in thickness, and peel off, leaving a sore surface, over which a fresh crust speedily forms. There is no analogy between this condition and psoriasis of the skin.

Yet a further development has been described as "ichthyosis," to which attention was first called by Hulke. Here there is still further thickening, the surface of the tongue being rendered hard and stiff, with numerous cracks, between which the epithelium forms hard elevated ridges.

The *etiology* of these various conditions is also as yet by no means clear. Certain influences undoubtedly predispose to or determine their origin, but how far these conditions are in themselves efficacious is unknown. The female sex is very rarely affected, and, in the male, cases fall usually between the ages of twenty and sixty years. But this limitation may be, and probably is, due to the prevalence in the adult male of other causes. Smoking seems undoubtedly to give rise to leucoma, and the so-called "smoker's patch" is merely a small patch of leucoma, arising usually at the point most exposed to irritation. Spirit drinking, and the use of strong condiments, have also probably with justice been regarded as causes. There is great probability that the friction of jagged teeth, and other irritants of any nature, may produce similar effects. Syphilis is usually stated to be a predisposing cause, but in the presence of so many other etiological factors its efficacy is difficult to prove. Barker states that of 110 cases of which he was able to obtain a history, 101 were males; there was ascertained syphilis in only 33 cases, and the majority, but by no means all, were smokers.

Of importance equally as great as its etiology is the *result* of chronic superficial glossitis. As has been already stated, the affection is in any of its stages very intractable, and there is no evidence of complete cure ever resulting. But if it do not pass beyond the stage of inflammation we have at most only a troublesome affection not endangering life. Unfortunately, however, old cases show a very marked tendency to further tissue changes resulting in the development of epithelioma. Out of Barker's 110 cases, no less than 43 were known eventually to result in the formation of cancer. How far these figures really represent the extent of the danger cannot yet be decided; but unquestionably a very large proportion of cases of leucoma, and therefore also, I would suppose, of the "red stage" of chronic superficial glossitis, result sooner or later in the development of cancer of the tongue.

The *treatment* of chronic superficial glossitis thus becomes of the utmost importance. It may be considered under three heads, viz. prophylactic, palliative, and radical.

A. The prophylactic treatment consists in the avoidance of those habits which are known to produce the disease, and especially immoderate smoking. If the least trace of leucoma be detected it will be well for the patient to give up smoking altogether, if he will, or at least to be very moderate; to use pipes with a long stem, cigars or cigarettes only with a holder, and to avoid allowing the stream to play upon the affected part. At the same time, stimulants and condiments must either be entirely avoided or used in the most dilute forms.

B. Palliative treatment consists in the use of soothing washes to the mouth, such as solutions of cocaine, bicarbonate of soda, borax, etc. The teeth should be kept clean, the mouth washed out after food. Caustics should be rigidly avoided, inasmuch as they increase the irritation, and may thus tend to induce epithelioma. Solutions of chromic acid, or of mercuric cyanide, are said to be useful, and in syphilitic cases the usual constitutional treatment may be adopted. I have found that painting the part with a mixture of salicylic acid and collodion gives great relief, especially when accompanied by the use of Donovan's solution.

C. Radical treatment by removal is not indicated in ordinary cases: if the patch be excised the affection will almost certainly recur, and with extensive tracts excision is impracticable. It is, however, quite otherwise in those cases where malignant infiltration appears to be commencing, or where the warty outgrowths giving rise to "ichthyosis" have formed. We have now to do no longer with an inflammation, but with a tumour, and early and complete removal is at once required. Should recurrence now occur it will be necessary to remove the tongue; but this subject is more fully discussed under the heading of epithelioma. The question will suggest itself, Would it not be well to remove the whole or part of the tongue in all cases of leucoma, without waiting for cancer, which will in so great probability develope? The answer depends mainly on the proportion of cases in which epithelioma does arise, a proportion which we cannot as yet definitely ascertain. It would, however, appear that in a very obstinate case of leucoma, especially where there are fissures, and much induration, and where the patient is over forty, the tongue should be removed, if the patient will submit to the operation; and the rapid increase in the death rate from cancer, to which I have elsewhere called attention, may cause such early operations to become generally adopted.

Urticaria of the tongue is rare, but may, by the rapid swelling to which it gives rise, cause much alarm, and it is liable to lead to mistakes in diagnosis. It causes great swelling and some pain. which, however, shortly subside, often to recur again and again.

Of late years has been described, mainly by Gubler and Barker, a peculiar affection of the mucous membrane of the tongue, called by the latter writer

annulus migrans. It consists in the formation of slightly raised red patches with a yellowish border, which spread rapidly in eccentric circles over the upper and under surface of the tongue, subsiding in the centre as they grow at the periphery. These circles may intersect, subside, and grow again in various ways, but do not quite disappear for a very long time. It is found mainly in children. The pathology of the disease is not known. In spite of its resemblance to tinea circinata, there is no reason to suppose that it is parasitic. Barker relates one case in which trichophyton tonsurans was found in scrapings, but others in which it has been sought for gave negative results. The prevailing theory is that it is an inflammatory process of neurotic origin. No treatment appears to have any effect.

Syphilitic affections of the tongue are numerous and important. In the first place we may here meet with chancre, which presents its usual characters, but which is less common on the tongue than on the lips and tonsil. In secondary syphilis are found mucous plaques, which have been already described. These form about the tip, borders, and back of the tongue, and are very prone to ulcerate where rubbed by the teeth. The relationship of syphilis to leucoma is not yet clear. In the treatment of secondary syphilitic affections the internal administration of mercury is indicated with local washes of solution of corrosive sublimate, or use may be made of chromic acid or mercuric cyanide, or the ethereal solution of salicylic acid.

The tongue suffers in tertiary syphilis from infiltration of its structure, just as do many other organs, and here, as elsewhere, the infiltration may be general and extensive, or localised in one or more points, the latter form constituting a gumma. Of the general infiltration Fournier describes two well-marked forms, viz. superficial glossitis and deep glossitis. I cannot regard these as inflammations in the ordinary sense of the word, but rather as of the nature of new growths, and I would therefore prefer some other term to that of "glossitis;" but as its use is general it is retained for the present. Would not cirrhosis be the best term to use, as implying no pathological theory, while indicating the analogy of this disease to syphilitic cirrhosis of the liver and other organs?

1. *Superficial glossitis* is an infiltration of the deeper layers of the mucous membrane of the tongue by round cells, which eventually become spindle-shaped or fibrous. The result is the formation of one or more smooth stiff patches on the surface of the tongue, where the papillæ have disappeared and the surface is of a deep red colour. These patches often run together over a large area. They are little or not at all painful. They have a great tendency to become cracked, and superficial fissures are thus formed, which are very troublesome to heal, and which may cause considerable deformity of the tongue. The affection is very chronic, even when treated as usual in syphilitic affections, and the patches leave pale contracted cicatrices.

2. *Deep glossitis* is a similar infiltration, affecting, however, the entire parenchyma of the tongue. In the early stage there is general hypertrophy of the organ, and very frequently this causes considerable superficial irritation by rubbing against the teeth. As a rule the hypertrophy is limited to the region of the dorsum, but sometimes affects the entire tongue. Succeeding this stage is that of cicatricial contraction, when the infiltrating tissue forms fibrous bands of varying thickness running through the entire organ and dividing it into lobules,

exactly as the liver is cut up by fibrous bands in cirrhosis. The entire tongue then becomes smaller, its surface is rendered puckered and uneven, and as some superficial infiltration is usually combined, often red and smooth. These two forms of "glossitis," occurring as they frequently do in conjunction, cause great and very characteristic deformity of the tongue.

Gummata of the tongue consist, like the two affections last described, in a small-celled infiltration, but differ in that they do not cicatrise, but either break down or undergo absorption, and in that they are much more localised. A gumma may be superficial or deep; the superficial, which are situated in the submucous region, or corium, being, as a rule, not larger than a large pea; while the deep, situated in the muscular tissue, may be as large as a hazel nut. They may be single, but there are often several. The gumma forms a hard mass, easily felt in the substance of the tongue when sought for, but often not noticed owing to its painlessness. The usual seat is the centre and back of the dorsum.

From other tumours of the tongue they differ in the frequent multiplicity, the painlessness, the presence of other signs of syphilis in the tongue or elsewhere, and in their ready curability by iodide of potassium. If the gumma fail to yield to the administration of iodide of potassium, it will sooner or later ulcerate, its substance breaking down into a semifluid mass, which is expelled by an opening, at first small but rapidly enlarging. The resulting ulcer forms a more or less regular circle or oval, with clean-cut edges of firm, but not very hard, consistence; the base is irregular, but devoid of granulations, and often has the peculiar wash-leather appearance of syphilitic ulcers. The edges may be somewhat undermined. There is frequently more than one such ulcer, and the tongue may present evidence elsewhere of syphilitic disease. These points will enable us to diagnose the affection; but we may note also that it differs from tubercular ulceration in the absence of a surrounding deposit of fine tubercles, in its more regular shape, in its greater depth as compared with its area, and in the absence of signs of pulmonary phthisis.

From chancre of the tongue it differs in that the cervical glands are rarely enlarged in the case of a gumma, whereas they always become so in chancre. Chancre will be followed by the appearance of secondary syphilitic symptoms: chancre is not benefited by the use of iodide of potash, and the general history of the patient will usually be a sufficient guide.

The differential diagnosis between an ulcerated gumma and an epithelioma is discussed on page 71. Here, as elsewhere, gummata usually yield well to iodide of potassium, which may be given in large doses with ferrum tart. Locally we may use an antiseptic mouth wash if ulceration has occurred. Should the sores not yield to this treatment there is some risk of the supervention of epithelioma, and it will probably be necessary to amputate the tongue, the less severe measures having had a fair trial.

Tumours of the tongue.—*Angioma* (nævus) has been found here not infrequently, and may be treated by ligature, puncturing with hot needles, cautery, or excision. If very large and spreading, it may necessitate removal of the tongue. *Fibroma* forms a firm very slowly growing isolated mass, which is quite painless and insensitive to pressure; it may be excised and there is no danger of recurrence. *Lipoma* is very rare; it forms a softish polypoid excrescence, often with a slightly yellow tint, and is readily removed. Chondroma, osteoma, and keloid are pathological curiosities.

Papillomata are common, forming small warty growths at the border or in the middle of the dorsum of the tongue. They are much exposed to irritation, and hence often become ulcerated, or in older people may develop into epithelioma. They should be removed early and freely, so as to take also some of the apparently healthy tissue. Should they return, as is often the case, they must be again removed, but any trace of deep infiltration of the tissue must be the signal for a more extensive operation.

The above tumours are all benign; but far more important are the malignant growths of the tongue. *Sarcoma* has been met with, but is exceedingly rare, and its characters cannot as yet be generalised. *Scirrhus* is equally uncommon.

Epithelioma of the tongue is one of the commonest and most terrible manifestations of malignant disease, constituting about eight per cent. of the total mortality from cancer. It is almost invariably met with in advanced life, and far more frequently in the male than in the female, in the proportion of 84·3 per cent. to 15·7 per cent., according to Barker's collected statistics. This difference in the susceptibility of the two sexes is perhaps partially accounted for by the tendency of the "cancerous diathesis" to manifest itself in the generative organs of the female, but a far more important factor is the prevalence in the male sex of other predisposing conditions. Practically these predisposing conditions are the same as those of leucoma which so often results in epithelioma. Smoking, abuse of condiments and spirits, and syphilis, may therefore all be regarded as tending to produce epithelioma. Further, any constant irritation of the tongue may lead to a development of cancer, and hence we must add to the category, chronic inflammation from whatever cause, the presence of jagged and decayed teeth, syphilitic lesions, and benign tumours of the tongue. The medicinal use of caustics in any of these affections will increase the irritation and the danger. Statistics show that cancer is more prevalent in low-lying and swampy districts than elsewhere; but there are no data to prove whether this peculiarity applies to epithelioma of the tongue. I have elsewhere pointed out the rapidly increasing mortality from cancer *in the male*, and here cancer of the tongue plays a most important part.

Epithelioma may arise upon any part of the tongue, but far more frequently on one side, and in the middle or posterior third than elsewhere. It may commence as a small nodule, as a crack which soon develops into an ulcer, or as a hard infiltration arising in connection with some pre-existing ulcer or growth. In any case there is shortly developed a superficial ulcer with hard indurated base and edges, consisting of cancerous tissue. The pathological nature of the growth is described in the article on Tumours.

At first there is but slight pain, but this soon increases, and, as a rule, becomes very severe, being greatly increased by the slightest movement of the tongue, as in speaking or eating. The infiltration spreads rapidly, and soon extends to the floor of the mouth, and to the fauces or the jaw. At an early stage the glands below the angle of the jaw also become affected and grow large, hard, and painful. Later on may arise cancerous deposit in internal organs, especially in the lungs, but dissemination is comparatively rare. The pain, salivation, the difficulty of eating, and the mental distress which ensue, are very severe, and soon greatly reduce the patient, producing a well-marked example of the "cancerous cachexia." Hæmorrhage may occur, and is either slight and continuous, or perforation of the lingual artery may cause a sudden gush and possibly close the scene.

The ulcer becomes very foul, and the breath has a disgusting odour, which adds to the patient's misery, while the inhalation of the decomposing materials is apt to lead to fatal pneumonia. If not relieved by operation the result is certain, early, and very painful death.

Owing to the necessity for prompt treatment, the *diagnosis* of epithelioma in an early stage is of the greatest importance. The description here given, compared with those of other affections of the tongue for which it might possibly be mistaken, will probably suffice for the student's guidance in most instances; but in all cases of doubt it is well not to wait very long, but to treat as epithelioma, especially in male patients advanced in life. The affection with which it is most liable to be confused is an ulcerating gumma; but the points of distinction are numerous, as will be seen from the following table taken from Mr. Southam's work on "Regional Surgery."

DIFFERENTIAL DIAGNOSIS OF EPITHELIOMA AND DEEP SYPHILITIC ULCER.

	EPITHELIOMA.	SYPHILITIC ULCER.
Cause . .	Often due to some local irritation, *e.g.* rough or carious teeth; smoking a clay pipe	Due to breaking down of a gummatous deposit, not to any local irritation
Age . . .	Generally over forty years .	Generally under forty years
Situation .	More commonly at one side, towards middle or posterior third	Often in median line towards median or posterior surface of dorsum
Shape . .	Irregular	Oval or round
Base . . .	Foul and sloughy; rough and irregular with well-marked and widespread induration	Deeply excavated; much less induration; often covered with a "wash-leather" slough
Edges . .	Raised, everted, thickened and indurated	Ragged and irregular; often sharply cut
Course . .	Ulceration primary, the induration about base being secondary to the ulceration	Ulceration secondary, *i.e.* the induration (viz. the gumma) breaks down and ulcerates

DIFFERENTIAL DIAGNOSIS OF EPITHELIOMA AND DEEP SYPHILITIC ULCER (*continued*).

	EPITHELIOMA.	SYPHILITIC ULCER.
Floor of mouth	Becomes involved, so that tongue after a time is tied down, fixed, immovable, and incapable of being protruded from the mouth	Not involved, so that tongue is freely movable, and capable of being protruded from the mouth
Speech . .	Soon interfered with owing to fixation of tongue	Not much affected, as tongue remains free
Pain . . .	Usually acute: often a prominent symptom	Generally slight . . . .
Glands . .	Those beneath the jaw (submaxillary) soon affected with secondary deposits	As a part of a general glandular implication, those in the neck (especially posterior cervical and occipital) may be slightly enlarged and indurated; at the same time the submaxillary may be affected, as the result of simple irritation propagated from the ulcer
Number. .	Generally single.	May be multiple, though usually single
Progress .	Generally rapid; floor of mouth, and in many cases the pillars of fauces becoming involved	Slow and stationary
Result of treatment	No effect	The ulcer heals, often leaving a deep fissured cicatrix. At same time the glandular enlargement, if due to simple irritation, also subsides
Concomitant symptoms	After a time, evidences of the cancerous cachexia	A history or other evidences of syphilis

Further, epithelioma may be distinguished by the method first insisted upon by Butlin, which consists in the microscopical examination of scrapings from the edge of the ulcer. The following appearances will probably be found, and are quite characteristic, viz. flattened and irregular cells, which are often coarsely granular, and frequently contain large nuclei and nucleoli; mother cells with enclosed daughter cells; cell nests.

Treatment.—Almost all the resources of surgery have been exhausted in the treatment of this serious affection, but we may narrow the field of choice by the following considerations. If the growth be entirely limited to the tongue, we should at once remove. If there be a fairly limited growth with slight glandular affection, we may remove the tongue and the glands either at the same time or by successive operations. If the floor of the mouth be affected, it is a grave question whether an operation will be of any service; but if there appear to be a fair chance of removing all the diseased tissue, we may attempt to do so, although we can hold out no strong hopes of prolonged relief. When the growth is extensive, the glands largely implicated, or where there is evidence of metastatic deposit in internal organs, we can only resort to palliative treatment. In the case, then, of a localised growth, we may adopt one of two courses, either removal of the part affected only, *i.e.* of one side of the tongue, or removal of the entire tongue. Of these two, the latter certainly commends itself; we increase the probability of removing the entire growth, the operation is but little more serious, and the result is no worse, inasmuch as half the tongue seems to be of very little use, becoming, as it does, bound down by cicatricial adhesions, and losing its mobility. Hence I unhesitatingly give the preference to removal of the entire tongue, an operation which is described below. In cases where the glands beneath the jaw are also enlarged they must be removed by the usual methods, an account of which does not come within the scope of this article. No definite rules can be laid down for clearing the floor of the mouth, the procedure being adapted to the nature of the individual case; but great care must be taken to remove the whole of the infiltrated tissue.

In those cases where removal is not advisable, something can be done to relieve the patient. The use of caustics, especially bromine, which was formerly resorted to, is now abandoned as mere cruelty. The internal remedies for cancer which have from time to time been advocated are valueless. More hopeful appears to be ligature of the lingual artery, thus arresting to some extent the flow of blood to the tongue, and thereby slowing the growth. Occasionally the same procedure is required to check hæmorrhage. Another valuable suggestion is to divide the lingual (gustatory) nerve. From within the mouth this nerve can be readily felt immediately beneath the mucous membrane, lying on the angle of the lower jaw, and vertically below the second lower molar tooth. It may here be cut down upon, drawn from its bed and divided; or better still, a portion may be excised. The procedure greatly relieves pain, diminishes salivation, and allows of movement of the tongue without the intense agony otherwise resulting. Its temporary value is great, but we greatly doubt the statement that the nerve does not reunite.

Pain may also be diminished by applying to the ulcer some powder, as bismuth. subnit., containing a little morphia; or, still better, by painting the diseased surface every four hours with a ten per cent. solution of cocaine. Applications of iodoform will control decomposition and diminish fœtor. Food must be fluid, and of the blandest possible nature, and if the pain is very great, nutrient enemata may be required. Hæmorrhage is to be controlled by styptic applications, or, if necessary, by ligature of the lingual artery.

Removal of the tongue.—It would be quite beyond the scope of the present essay to describe all the numerous operations and modifications which have been adopted, or to discuss their various advantages and disadvantages, and I must content myself with an outline of the subject, referring the reader to the excellent account in Mr. Butlin's "Diseases of the Tongue."

Omitting the earlier operations, the first valuable procedure was that of Chassaignac, who introduced an écraseur through the floor of the mouth above the hyoid bone, and thus removed the organ as far back as possible. The écraseur is also used through the mouth, the frænum and inferior muscular attachments of the tongue being first divided to allow of free protrusion. The special advantage claimed for this method is the absence of hæmorrhage; but this is not invariable, and it is open to the objections that considerable sloughing of the bruised tissues often results, and that we cannot thoroughly control the direction of the incision, or ascertain the existence of infiltration behind it. The same objections apply with even greater force to the use of the galvanic écraseur, as introduced by Middledorpf, and strongly advocated in this country by Bryant.

A more complicated procedure, of which there are several modifications, consisted in division of the lower jaw and removal of the tongue through the opening thus made. Syme divided the jaw in the line of the symphysis and removed the tongue by the scalpel. Sédillot's procedure was similar, but he made the cut in the jaw dovetailed, to render easier subsequent replacement. Billroth divided the jaw on either side and turned it down as a flap. Langenbeck divided it on one side. These methods may be of occasional service when there is infiltration of the floor of the mouth and an extensive removal is contemplated; but in ordinary cases they are needless complications, greatly increasing the danger.

Regnoli's method consisted in carrying a vertical cut from the symphysis menti to the hyoid, with a curved incision on either side running along the lower border of the lower jaw so as to form a somewhat T-shaped incision; through the large opening thus made in the floor of the mouth he removed the tongue. Billroth dispensed with the vertical incision, and made the curved one longer. These operations also may occasionally be useful for clearing the floor of the mouth.

Mirault, Billroth, and Kocher advocate preliminary ligature of the lingual artery to avoid hæmorrhage, but experience has convinced us that this is not necessary. Barker and Kocher simultaneously suggested a preliminary tracheotomy, in order that the patient should not inhale the fœtid discharge resulting from healing of the stump. There can be no doubt of the importance of this precaution, but possibly the local application of iodoform will enable us to dispense with it. Kocher's operation is one of the most complicated, and is designed to remove both tongue and glands, while preventing hæmorrhage by ligature of the lingual artery, protecting the lungs from fœtid inhalations by a preliminary tracheotomy, and allowing of antiseptic dressing of the wound. A full description will be found in Mr. Butlin's work.

The method of Morrant Baker consists in splitting the tongue longitudinally along the middle line, then freeing with scissors the mucous and muscular attachments of the diseased half, drawing it well forwards, and passing an écraseur round its base. The opposite half is then removed, "in the event of both sides of the tongue requiring removal." For reasons above stated, I prefer in all cases entire excision; but there can be no doubt that, if we are to use the écraseur, a great advantage is gained by first splitting the tongue, so as to allow of more complete control over our line of division. This method is now largely employed, and has yielded excellent results.

Some few years since I advocated excision of the tongue by means of scissors only. The head being placed in a good light, and a gag introduced, the organ is drawn well forwards by a ligature through its tip. With a pair of sharp scissors the frænum is then divided, and, strong traction being made on the tongue, its attachments are gradually freed by a series of short snips carried as far back as possible. The lingual arteries will probably require securing as they are cut, and may be twisted or ligatured. The base is kept under control by a strong silk ligature passed through it, which is retained for one day. I have never seen any trouble from hæmorrhage, the *bête noir* of operators upon the tongue.

The *after-treatment* of a case of excision of the tongue is probably of more importance than the precise method adopted for its removal. The patient is generally already in a low state of health, and the difficulty of feeding him, the inhalation of fœtid products of decomposition, with the mental distress resulting from the loss of the power of speech, render this period exceptionally dangerous. We have mainly to keep up the strength by suitable food, and to counteract the tendency to septic pneumonia. Other dangers are common to this and to all serious operations. Nourishment may be administered partly per rectum. By the stomach food may be given by means of a soft tube passed well over the stump and down the œsophagus, or a similar tube may be introduced into the gullet through the nose. As an antiseptic I have for some time used iodoform, either as powder or in ethereal solution, which may be painted on the well-dried stump. The recent introduction of "iodoform gauze" has, however, proved an equally convenient and efficient means. The stump is well dried, and then every crevice packed, and the floor of the mouth covered with fine gauze impregnated with iodoform; this remains *in situ* for several days until the wound is practically healed. It keeps down all offensive smell, and allows of the use of fluid food without the necessity for an œsophageal tube. Finally, the patient should not be allowed to make any attempt at speech for at least a week after the operation.

The proportion of apparent recoveries (when there was no return of the growth for twelve months or more) after excision of the tongue is estimated at from 10 to 15 per cent.; but these figures must be accepted with reserve, inasmuch as the diagnosis is not in all cases confirmed by a microscopical examination, and some of these cases may possibly not have been epithelioma. The death rate of the operation is about 12 per cent., being somewhat higher in cases of removal by scissors; but this is partly to be explained by the fact that only the less severe cases can be operated upon by the écraseur. The average increment of life after operation is probably about six months; and, slight as the gain may thus seem to be, it is really a great one, as the death from recurrence is usually much less painful than that from the primary disease.

The main cause of the mortality is some form of septic pneumonia; but erysipelas, pyæmia, gangrene, and exhaustion also play their part. I have, however, great hopes that, with improved methods of after-treatment, earlier diagnosis, and therefore earlier operation, excision of the tongue will speedily become a less formidable procedure than it at present is.

VI. AFFECTIONS OF THE FAUCES AND TONSILS.

Elongation of the uvula may result from acute or chronic catarrh. In the acute form the uvula is elongated, thickened, and œdematous. It forms a soft, semitranslucent mass, hanging down from the soft palate, and causing tickling of the fauces and great irritation. If the ordinary treatment of catarrh is not followed by its recession, scarification may be adopted, and will give rise to an exudation of watery blood, after which it will probably shrink up.

In chronic cases elongated uvula frequently accompanies hypertrophy of the tonsils, being due to the same general conditions, and aiding in keeping up the irritation which leads to that hypertrophy. The uvula may even hang down into the larynx, and by irritating the glottis may cause serious spasm, while in all cases it causes unpleasant tickling and perhaps nausea. In such cases it may be removed. In amputating the uvula, the only point of importance is to ensure that the part removed shall not drop into or upon the glottis. This may be simply effected by seizing its tip in a pair of forceps and cutting it through above with scissors. Or scissors may be used with hooks placed on the under side of both blades so as to seize and retain the tip while they cut through the base of the organ. Various other uvulatomes of more or less complicated nature have been constructed, but one of these simple methods will suffice. The cut surface heals readily, but the operation is usually followed by a somewhat acute catarrh, lasting for a day or two, of which the patient should be forewarned.

Hypertrophy of the tonsils often necessitates operative interference. It results from a chronic process, probably of inflammatory nature, and is found mainly in young persons at or before the age of puberty, and more often in boys than in girls. In nearly all cases the patients are strumous, and have been subject to recurring attacks of tonsillitis. The hypertrophied nodules approach one another and may almost fill up the fauces, seizing the uvula between them, so as to compress and elongate it; or even by mutual pressure causing ulceration. They seriously obstruct respiration and deglutition, and as each inflammatory attack recurs, cause much pain and increase the difficulty of breathing, and may even, if not relieved, cause suffocation. Attempts may be made to promote their absorption by general hygienic and anti-strumous treatment, by local application of perchloride of iron or other astringent, or by painting the throat externally with iodine. But if these measures do not cause diminution in size, the growth must be removed. This may be done by aid of a knife made like a hernia bistoury, with a rather longer cutting edge, or by an ordinary probe-pointed bistoury, the upper part of the blade being guarded by enclosing it in strapping. The tonsil is seized in a tenaculum forceps, and pulled inwards slightly, the knife being introduced below and a cut carried upwards and slightly inwards. It is not necessary to remove the entire mass, as what is left will cicatrise and shrink up, while too deep a cut might endanger the internal carotid artery lying to the outside of the tonsil. To expedite this little operation have been invented various forms of tonsil guillotine, which at once seize and remove the growth. A moment's inspection of one of these instruments will explain its use better than any written description. For children and very nervous persons the guillotine is perhaps an advantage, as only one instrument need be introduced into the mouth; but in most cases we consider that the knife will be equally convenient, while if chloroform be given there can be no possible objection to its use. Some hæmorrhage may follow excision of the tonsil, but is usually easily checked by sucking ice or tannin lozenges; if this fail, we may paint the surface of the wound with a little tinct. ferri perchlor. The inflammation which follows the operation is treated as an ordinary acute catarrh, and the wound soon heals.

Syphilitic affections of the tonsil and fauces resemble those of other parts of the mouth (*q.v.*). Chancre of the tonsil is rare. It is important to diagnose it from epithelioma. Mucous plaques are less frequent here than in some other parts of the mouth. Gummata are not rare either in the tonsil or velum palati.

Epithelioma may be primary in the tonsil, and resembles in its characters epithelioma of the tongue. It usually spreads rapidly to surrounding parts, and causes glandular and general infection. In an early stage it may be removed, but if advanced, palliative treatment is alone possible.

Sarcoma is more common than cancer. Of twelve cases collected by Butlin, of malignant disease of the tonsil, which had been microscopically examined, nine were sarcomata. This form of tumour grows rapidly as a soft mass, but has less tendency to ulcerate than has epithelioma. It also affects the glands and viscera.

Abscess of the tonsil may result from tonsillitis, and should be opened early with a sharp-pointed knife (a tenotomy knife will do well); pus and blood escape, at once relieving pain and swelling, and a cure will probably soon follow. In the case of small follicular abscesses it is generally possible to evacuate the pus by introducing a probe through the opening of the follicle.

Calcareous **concretions** sometimes occur in the crypts of the tonsil, and if not removed they irritate and keep up the chronic inflammation which is at once their cause and their effect. If superficial they may be scraped off or picked out with forceps; or if deeper a slight cut will suffice to liberate them.

VII. AFFECTIONS OF THE PHARYNX.

Pharyngitis may be acute or chronic. With the acute form, which is a simple catarrh, we have nothing to do. The chronic form may be due to repeated attacks of acute sore throat, or to exposure to damp or to dust, or to syphilis. It is most common in those of a strumous constitution. All ages are subject to it, but the determining cause varies at different periods; and thus, while in children it is probably due to cold and damp, with a strumous diathesis, in adults we must rather look to over-exertion, syphilis, or inhalation of dust. In its simplest form this affection causes merely dryness and irritability of the mucous membrane, which is seen to be of a dusky red colour, with dilatation of the veins. This condition is often very intractable, and keeps up a constant irritation with muco-purulent secretion. But in other cases there results "granular pharyngitis," the numerous lymphatic follicles of the pharynx becoming enlarged, and forming small prominences on its surface. In some cases a collection of these follicles, which occupies the upper part of the pharynx, in the middle line, becomes much enlarged, forming a very distinct "third tonsil." Not uncommonly, also, the small mucous crypts become obstructed, and then distended, either with a clear fluid, forming little cysts, or with pus, forming superficial abscesses. All of these complications tend to increase the irritation, and to render the disease more intractable.

In all chronic cases we must search for, and if found, remove, the above-mentioned causes of pharyngitis. Locally, use may be made of astringent gargles and lozenges; and inhalation of steam, either alone or with tinct. benz. co., will alleviate the irritation. If this fail to cure, as it often will do in the granular form, the follicles may be touched from time to time with some caustic paste, or with nitrate of silver. Cysts, or small abscesses, must be opened by a knife having a small blade situated at the end of a long, fine handle. If the third tonsil be much enlarged it will require removal.

Phlegmonous pharyngitis is usually the result of some severe chemical or mechanical injury, or of an acute pharyngitis in an unhealthy subject, and its symptoms will be merged with those of severe inflammation of surrounding parts, of which the most serious are dependent upon œdema glottidis. It may result in gangrene. The only available local treatment consists in the use of steam inhalations, with ice to suck, and as soon as distinct abscesses form they should be opened.

Tumours are not very frequently primary in the pharynx, but often extend thither. First to be named is papilloma, which is usually simple, and requires only removal with the scissors, its base being cauterised. Fibroma and lipoma are also occasionally found here. Epithelioma of the tonsil extends to the pharynx. So do the various tumours of the upper jaw and nose, and sarcoma springing from the base of the skull, or the bodies of the cervical vertebræ, projects here.

Retro-pharyngeal abscess, or abscess in the cellular tissue, lying between the posterior wall of the pharynx and the bodies of the cervical vertebræ, is usually met with in strumous children. In adults it is rare. Most cases cannot be traced to any definite cause, and are therefore classed as idiopathic. In others it is due to scarlatina, where it may be connected with suppuration of the tonsils; less often it is due to spinal caries, to the irritation produced by impacted foreign bodies, or to extension of suppuration from other parts. Whatever the cause, the abscess probably first attracts attention by causing difficulty of swallowing or of breathing, and local examination then discovers, at the back of the pharynx, a soft, moderately tense, fluctuating, rounded swelling, lying sometimes in the middle line, more often somewhat laterally. Pressure upon the swelling causes no diminution of size. There is often some stiffness of the neck, and where the abscess is lateral, the head may be bent to the opposite side. The sterno-mastoid muscles may be firmly contracted, to prevent movement of the head, and there may be external swelling of the neck. If left to itself the abscess will eventually burst. It may do so into the pharynx, in which case the pus may be swallowed or coughed up; or it may flood the larynx, and the patient is drowned in pus. In other cases, instead of opening in the pharynx, the pus gravitates downwards into the posterior mediastinum, setting up acute mediastinitis, which will prove fatal. Or it may pass outwards laterally to the neck, in which case it cannot find its way backwards, owing to the strong fascia, but is carried behind and along the carotid sheath, opening in front of the sterno-mastoid muscle. Or the inflammation may extend to the tissues of the glottis, setting up inflammation and œdema, with its usual dangers.

From this brief account of the possible results of retro-pharyngeal abscess, it will be seen that the treatment must consist in removing the pus as soon as possible. This may readily be done by using a large trocar and canula, the abscess being freely opened by the knife after evacuation of the pus. The preliminary tapping is required to prevent flooding of the larynx. If this treatment be adopted, the prognosis is in the idiopathic cases good, but in cervical caries and scarlatina the primary disease will probably have a fatal issue. If sinuses have formed in the neck, it is well to make a counter-opening in the pharynx, and endeavour by the usual means to promote healing of the sinuses.

III. DISEASES OF THE JAWS.

AUGUSTUS J. PEPPER.

Congenital deformities of the jaws.—With the exception of malformations of the palatal process of the maxilla, discussed in another chapter, congenital deformities of the jaws are extremely rare. The mandible is usually affected. Thus, in *congenital dislocation* there is more or less associated deformity of the bone arising partly from the developmental error, and partly from the interference with the action of the muscles which act upon the articulation. In other cases the lower jaw is *congenitally small* from arrested development without luxation of the temporo-maxillary joint.

Diseases of the gums. — 1. *Simple hypertrophy* of the mucous and submucous tissue of the gums sometimes reaches extraordinary dimensions ; in fact, the teeth may be almost hidden by a vascular fungoid mass. The disease is incidental to childhood, although cases are recorded of the affection in the adult, but in them it appears to have commenced very early. The cause is quite obscure. In the majority of the recorded cases there is defective mental power.

The *treatment* consists in excising the growth. Where it is extensive it is better to remove a piece of the alveolus with it.

2. *Spongy gums.*—The gums are liable to undergo inflammatory swelling and vascular engorgement from a variety of causes. They partake of the general swelling consequent on irritation of the adjacent periosteum and bone. They may inflame and even ulcerate from an accumulation of tartar. But

reference is here made chiefly to the state induced by some constitutional disease, *e.g.* scurvy, scrofula, syphilis; or chronic mercurial poisoning. It is by no means uncommon to find them ulcerated, either alone or as part of a more general stomatitis. This is notably the case in cancrum oris. Formerly, when it was the fashion to treat syphilis by the administration of mercury until excessive ptyalism was obtained, the unfortunate patients were subjected to the most horrible sufferings; the gums being swollen to a degree, bleeding freely, and exhaling the most fœtid odour.

The *treatment* should be directed to the removal of the cause; to the cleansing of the parts by means of detergent and astringent washes; and to supporting the strength by tonics and a liberal diet.

3. *Lead staining.*—This is seen as a blue line on the gums in cases of chronic poisoning by the metal. The colour is due to the formation of plumbic sulphide; the base, which is contained in the blood as a soluble salt, combining with the sulphur of the sulphuretted hydrogen set free by the decomposition of particles of food and albuminised discharges from carious teeth.

Treatment.—Interdict the further ingestion of lead. Give iodide of potassium with a view of dissolving the metal deposited in the tissues; and follow this up with a quinine and iron tonic.

4. In Addison's disease pigmented patches are occasionally met with in the gums.

5. *Irritable gums from teething.*—In addition to the local discomfort, infants often suffer from various reflex disorders consequent on the irritation of the gums whilst cutting the teeth. Immediate and marked relief is afforded by free lancing, and this should be resorted to without delay.

6. *Polypus and papilloma of the gum* will be

recognised by their general characters, by their localisation, and by the fact that neither the periosteum nor the bone is affected. They should be excised, and their bases cauterised.

Epulis. — Although epulides are usually described with diseases of the gums, they probably in all cases spring either from the periosteum or the bone, or at any rate affect those tissues quite early.

The chief varieties are (1) fibrous and (2) myeloid.

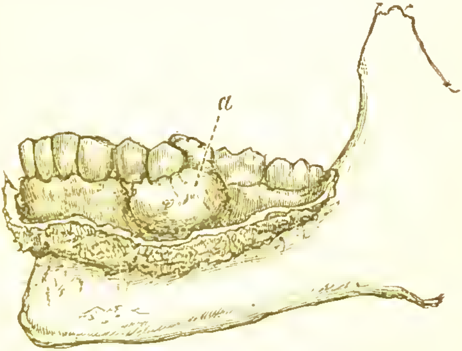

Fig. 9.—*a*, Fibrous Epulis of Lower Jaw. The growth is seen to be attached to the wall of the alveolus, and to project between the teeth.

Exceptionally, an epulis contains cell nests, and is thus epitheliomatous in its nature.

Fibrous epulis is a firm, rounded, or lobulated tumour. It grows slowly, and does not recur after complete removal. The tissue of which it is composed is covered by thickened gum. It often ossifies, the bone radiating from the attachment of the tumour to the jaw.

Myeloid epulis is more frequently connected with the alveolus than is the fibrous form. It is exceptionally an outgrowth of a central myeloid sarcoma of the jaw. As a rule it is highly vascular, soft, and of a red or purple colour. It rarely ossifies; when it springs from the lining membrane of the alveolus it projects as a spongy mass by the side of or between the teeth. Microscopically it is characterised by the presence of giant multinucleated cells, embedded in round, oat-shaped, or angular corpuscles.* Both fibrous and myeloid epulides may occur at any age, but they select by preference youth and early and mid-adult life.

Treatment of epulis.—Nothing short of complete removal affords a reasonable expectation of immunity from recurrence. As regards the fibrous variety, it is generally enough to excise the tumour and scrape the bone at the site of its attachment. When a myeloid epulis springs from the alveolus it is advisable to cut away a portion of bone. If this can be done without sacrificing a tooth, so much the better; but rather than run the risk of a return of the disease, it is better to extract one or more, according to the breadth of the base of the tumour; except in cases of epulides connected with central sarcoma, it is not necessary to remove a portion of the entire depth of the jaw. The alveolus can be readily excised by notching the bone vertically on each side of the epulis, and then completing the operation by means of cross-cutting forceps. Should the wound bleed freely, the hæmorrhage must be arrested by means of a lint compress kept in position by firm closure of the mouth.

Epitheliomatous epulis is a more formidable affection than either the fibrous or the myeloid, for it has a great tendency to invade the interior of the bone, and in the case of the upper jaw to reach the antrum.

Alveolar abscess is of two kinds, superficial and deep. *Superficial alveolar abscess*, commonly known as *gum-boil*, is mostly associated with carious teeth, but it may be caused by cold and other sources of irritation. It forms a small localised puffy swelling of the gum, which bursts spontaneously or on pressure with the finger. It seldom requires surgical treatment. *Deep alveolar abscess* is situated at the fang of a tooth. It gives rise to tensive aching pain. The pus wells up by the side of the tooth, or if the resistance to its passage be too great in this direction, it finds its way through one or other of the compact layers of the alveolus. Before the latter event is accomplished, the periosteum may be undermined by inflammatory exudation, and more or less necrosis of the bone determined. In the upper jaw the pus frequently burrows between the periosteum and the palatal process; when the abscess points in the roof of the mouth, it may be as far back as the junction of the hard and soft palate. Before bursting, or even afterwards, the swelling may simulate a new growth. Again, the floor of the nasal fossa may be perforated, and the discharge as it drains from the nostril may at first sight be mistaken as a sign of *ozæna*, but there is little or no fœtor of the breath.

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* *Vide* Pepper's "Surgical Pathology," Fig. 69, p. 468. 2nd ed.

Treatment.—Extract the tooth without delay. This may suffice; but if the abscess has passed the limits of the socket it will require a free puncture. Wash the mouth out frequently with hot water, and cleanse the abscess cavity with a weak solution of Condy's fluid.

Abscesses of the lower jaw are divided into chronic and acute. *Chronic abscess* may form in connection with the fang of a tooth, or result from suppuration in a dentigerous cyst (*q. v.*). In the former case it is often small, and apparently encapsuled. A suppurating dentigerous cyst will be diagnosed by the symptoms of acute inflammation supervening on expansion of the compact laminæ of the jaw, and by the finding of a misplaced tooth in the floor of the cavity.

The *treatment* of the latter variety is practically the same as for a cyst without suppuration, viz. to remove a portion of the wall and extract the tooth.

Acute subperiosteal abscess may develop without any assignable cause. The most common antecedents are caries of the teeth, injury, and exposure to cold. Impairment of the general health strongly predisposes to the onset of the inflammation. The symptoms are those usually met with in suppuration beneath resisting structures, viz. severe aching and throbbing pain, tenderness to touch, and marked constitutional disturbance. In addition to these are others referable to the locality of the abscess. There is spasmodic closure of the jaws. The teeth feel as though raised from their sockets. There is often reflex pain in other parts supplied by the branches of the fifth nerve. In severe and advanced cases the cheek is much swollen, and the skin over the jaw is tense and shiny. Unless the pus is let out early there is great peril of necrosis. The abscess usually bursts into the mouth either on the lingual or buccal surface of the bone, or at the alveolar border. It may open externally near the angle of the jaw.

Treatment.—If the patient is seen ere the exudation has become purulent, an attempt may be made to arrest the inflammation by puncture, extraction of carious teeth, leeching of the gum, or skin just below the angle of the jaw; and by fomenting the parts internally with hot water, and externally with boracic lint poultices. As soon as pus is formed, it must be let out by a free incision, preferably in the mouth, but wherever the abscess shows signs of pointing. The after-treatment includes free drainage and the use of detergent lotions. If the bone has necrosed it must be left to separate before it is removed.

Necrosis.—The following conditions are liable to set up suppurative inflammation, and necrosis of the jaws. (1) Injury; (2) caries of the teeth; (3) acute fevers; (4) struma; (5) syphilis; (6) excessive use of mercury; (7) irritation of phosphorus fumes. Not seldom there is a combination of causes, and one may be said to predispose to the action of another; thus, in a scrofulous patient a slight blow may suffice to light up the inflammatory storm; and phosphorus necrosis is rarely seen apart from the pre-existence of caries of the teeth. So, too, mercurialisation and the disease it is intended to cure (syphilis) may act jointly in the induction of necrosis. Lastly, the cause may be obscure.

The earlier *symptoms* have been given under the respective heads of "alveolar" and "periosteal" abscess. They vary in intensity according to the cause of the inflammation; the general state of health of the patient, and the time at which efficient treatment is commenced. When the necrosis forms part of a gangrenous stomatitis supervening on an acute specific fever the suffering may be comparatively slight. I have known an almost "silent necrosis" involve the greater part of the upper jaw in a child marasmic from typhoid fever. It may be said that the more rapid and profuse the formation of pus in the initial stages of the disease, the more pronounced will be the local and general symptoms. *Loss of appetite and disordered digestion* need special mention, for besides the usual effects of acute inflammation ending in necrosis, the patient experiences difficulty in the ingestion of food; copious and continual salivation, and gastric irritation from the swallowing of fœtid discharges. I am fully convinced of the truth of the latter part of this assertion, although it has been questioned by some, for I have observed the strength and appearance of the patient improve very rapidly on the removal of the necrosed bone, which acts as a mechanical irritant by its movement when loose, and as a bar against effectual drainage of the sequestrum cavity.

The symptoms of *necrosis* may be associated with those of *caries*, especially where the lesion is entirely or in part dependent on constitutional depravity as obtains in scrofula, syphilis, etc. This will be indicated by (1) the continued and progressive course of the disease after the primary abscess has been opened (2) by the probe coming in contact with soft disintegrating tissue as well as meeting with the dead resistance of necrosed bone.

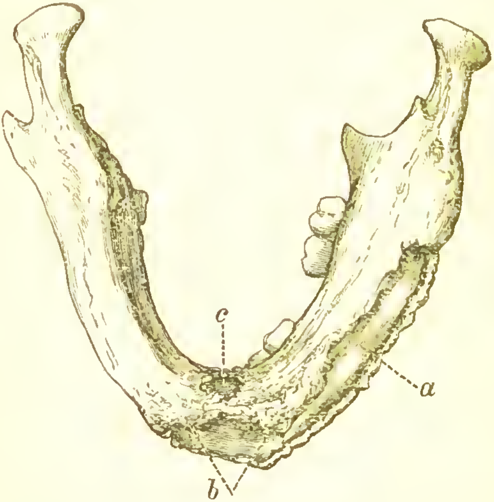

Fig. 10.—Syphilitic Necrosis of the Lower Jaw.

a, Necrosed bone; *b*, deposit of new bone; *c*, cloaca leading to sequestrum cavity. (From St. Mary's Hospital Museum; *Ab*, 139.)

Phosphorus necrosis is characterised by: 1. The insidious onset of the lesion. 2. Its sometimes appalling extent. 3. The superabundant formation of soft spongy bone, the osteo-plastic and destructive processes going hand in hand together. It rarely develops except in the presence of caries of the teeth; some surgeons say never, but Langenbeck denies this. The immediate cause seems to be the irritation from the oxydised products of phosphorus, most likely phosphorous acid. The disease is not nearly so frequent as formerly, for red amorphous phosphorus is largely substituted in the manufactures for the yellow, readily oxydisable poisonous variety; and the factories act enjoins the compulsory examination of operatives, and so saves them from the possible results of their dangerous occupation. Although, as before said, a large amount of new bone is formed around the necrotic portions, it becomes rapidly less by absorption, after the sequestra are removed. The soft tissues about the jaw are much swollen and spongy, and they bleed freely on the least provocation. The entire jaw may lose its vitality. In one case the carotid artery had to be tied to arrest the hæmorrhage attendant on the operation of sequestrotomy.

Treatment of necrosis of the jaw.—It may be laid down as a general rule, that the dead bone should be allowed to separate before an attempt is made to remove it: 1. Because prior to this, the extent of the necrosis may not be evident. 2. Because when the necrosis involves the whole or the greater part of the thickness of the jaw, the force employed may fracture the surrounding deposit, and any of the old bone that may have retained its vitality. Apropos of the danger of fracture, I may say that I have known the action of the powerful masticatory muscles to suddenly snap the bridge of new bone left after extraction of a large sequestrum from the lower jaw, ten days after sequestrotomy. From this experience I advise the surgeon, in cases where the new bone is very porous, or deficient in amount, to restrict the movement of the jaw after the operation until the necessary support is obtained. With this end in view the patient should be ordered liquid and minced food. Except where the necrosis is superficial, *e.g.* at the angle of the jaw, and the dead bone can be extracted by enlarging an external sinus, the sequestra should be removed through the mouth. There are few cases that do not admit of this procedure. To facilitate the operation it may be expedient to divide the sequestrum with cutting forceps. Care should be taken to apply traction in the axis of the bone, especially when the necrosis affects the ascending ramus. Twisting of a fragment might wound the inferior dental artery. The patient should be told not to swallow the discharge, and in order that it may drain through the mouth during sleep, he should be advised to lie on the affected side. To prevent the matter becoming pent up or burrowing, it is well to plug lightly the cavity which furnishes it. Decomposition should be checked by the frequent use of antiseptic lotions. Any loose or carious teeth in the vicinity of the necrosis must be drawn.

Diseases of the temporo-maxillary articulation.—A. *Chronic rheumatic arthritis* is a disease, incidental to advanced life. It is comparatively rare. It may affect one or both joints. The pathological changes are of the same nature as obtains in the other joints, *e.g.* the hip. There is a gradual absorption of the articular cartilage. The interarticular fibro-cartilage disappears. Simultaneous with the destructive process, a quantity of new bone is formed, so that the condyle of the jaw is much enlarged, it may be to such an extent, when the disease is unilateral, as to tilt the chin towards the opposite side. Greater freedom of movement in a forward direction is allowed by the absorption of the eminentia articularis. This may be so marked as to amount to a partial dislocation, which, of course, is apt to recur. The dislocating force is the action of the external pterygoid muscle. When both joints are affected, the jaw is carried directly forwards by reason of the luxation. The patient complains of more or less aching pain in the part, and a sensation of creaking when the joint is moved. The cervical lymphatic glands may undergo irritative enlargement. In extreme cases, movement of the jaw is practically impossible. The *treatment* consists in giving iodide of potassium, and in the application of counter-irritants over the articulation. If the deformity is great and the jaw fixed, the condyle may be excised. The disease is incurable.

B. *Acute arthritis* is caused by (*a*) traumatism; (*b*) inflammation of the middle ear, extending to the joint through a fissure in the tympanic plate (Barker). This variety, like the following, is mostly met with in children. (*c*) Acute exanthematous fevers, especially scarlatina. The *symptoms* are swelling below the zygomata. Severe pain, increased by pressure, or by an attempt at movement of the jaw, which is checked directly by the swelling, and reflexly by the pain. If suppuration occurs, the pus escapes by a sinus on to the face; or by way of the external auditory meatus.

Treatment.—Rest the joint. To carry this out the patient should be placed on liquid diet. If the inflammation is severe, apply a couple of leeches over the articulation. Foment the part and protect from cold. If the middle ear is diseased it will require attention.

C. *Enlargement of the condyle of the lower jaw* may arise from injury, but as a rule it is the result of chronic rheumatic inflammation, associated or not with affection of other joints. It may so seriously impede the movement of the jaw as to necessitate removal of the enlarged mass.

Ankylosis of the jaws is the abiding result of past arthritis. The bones may be united by fibrous bands or by bone. The patient is unable to masticate.

Treatment.—If the ankylosis is of the fibrous variety, the surgeon should attempt to remove the adhesions either by means of a screw gag or by passing a tenotome into the joint. Should these means fail the condyle must be excised; this is best done by a T-shaped incision, the larger horizontal cut being made just below the zygoma, and the vertical one below this. The temporal artery should not be divided. The condyle can be raised from its bed by means of an elevator. Osseous ankylosis peremptorily calls for excision. It may be necessary to saw the bone twice, at the neck and through the line of union; but usually one cut is sufficient, the condyle being then wrenched away from the temporal bone. The operation, on the whole, is very successful in restoring the movement of the jaw.

Closure of the jaws is of two varieties: 1. Spasmodic. 2. Organic. Spasmodic closure is due to reflex contraction of the muscles, from acute irritation of one of the branches of the fifth nerve supplying the jaws and teeth. It is seen in varying degree during the cutting of the wisdom teeth. Organic or permanent closure may arise from (*a*) ankylosis of the joint; (*b*) contraction of cicatrices within the mouth; (*c*) contraction of inflammatory lymph effused into the masseter muscle. Cicatricial contraction of the mucous membrane and deeper tissues of the cheek is the result of acute destructive inflammation, or of gangrene. It is a sequel of ulcerative stomatitis, and of cancrum oris, and is consequently met with after the acute fevers, chronic mercurial poisoning, etc. It may also be a consequence of cauterisation or corrosion. The natural elasticity of the parts is replaced by fixed rigidity, so that the jaws are held firmly in contact. I have more than once seen almost complete closure as a consequence of simple and syphilitic plastic periostitis of the ramus of the jaw, the masseter muscle being invaded and stiffened by the inflammatory process. If there is destruction of the mucous membrane throughout its full depth, viz. from one jaw to the other, closure is an inevitable result, and the chances of attaining useful movement turn upon the success attending *surgical treatment.* If the cicatricial band is a narrow one, it may be possible to restore the mucous membrane by a plastic operation; or to stretch the band by a spring or lever gag.

In severe cases but little good can be expected from this procedure; firstly, because it requires to be carried out systematically, and for a long time, and patients get tired of the pain and inconvenience; and secondly, because the contraction returns with certainty when the treatment is discontinued. If the process of stretching the cicatricial tissue fails, or it is not deemed expedient to resort to it, the patient must either go unrelieved, or submit to *division of the lower jaw* in front of the contraction. It is certainly the surgeon's duty to advise the operation, since it is not attended with much danger, and if properly performed it gives excellent results. The object in view is to establish a false joint. To effect this Esmarch's operation is the best. It consists in removing a wedge-shaped piece from the lower jaw, the apex of the wedge being at the alveolar border. To be secure against ankylosis at the seat of operation, it is necessary that the base of the wedge should be nearly an inch in length. The alternative operation, Rizzoli's, is simple division of the jaw from within the mouth by means of cutting forceps.

If the closure depends on interstitial contraction of the masseter, the muscle should be gradually stretched by forcing open the mouth by mechanical apparatus, and if this does not succeed it should be divided by a tenotome passed through the mucous membrane of the cheek. Care must be taken to avoid wounding any large vessel. The bleeding that ensues on incising the muscle can be arrested by firm pressure with a pad and bandage applied over the ramus of the jaw. I have known considerable relief follow the administration of iodide of potassium in cases where the masseter has become implicated by the inflammation which started as syphilitic periostitis. Commencing with five grains, the dose should be rapidly pushed to twenty-five grains three times a day.

Diseases of the antrum.—An *abscess* of the antrum in the majority of cases originates in connection with a carious tooth. This is not surprising when the close proximity of the dental fangs to the maxillary sinus, or even their exposure in the cavity, is considered. Occasionally it is the result of injury, when it is more acute in its progress. As a rule its course is chronic, and inasmuch as the pus is not encapsuled, it is not a common event for the cheek to become bulged. Exceptionally, however, the aperture leading to the dental fossa is contracted or occluded by the inflammatory swelling, so that the walls undergo expansion from the pressure of the contents. This is more likely to happen if escape for the pus by way of the tooth sockets is inefficient. Any one of the walls (buccal, nasal, palatal, orbital) may be bulged. Usually the pus makes its way out from the nostril, or into the mouth. Apart from swelling, the patient experiences a dull aching pain in the jaw. The nasal duct is liable to be obstructed, and epiphora ensue as a consequence. It is rare for the sight to be affected by extension of the inflammation to the contents of the orbit, or by pressure of the orbital plate upon them.

Treatment.—Extract any carious tooth, or remove a canine or the second molar, and make a free opening into the antrum through the bottom of the socket. Care must be taken in the latter procedure not to fracture the floor of the orbit. To avoid this the perforator or gimlet must be kept under firm control. If the jaw is an edentulous one, and the alveoli are filled in with bone, it is better to go in through the canine fossa. Having established free drainage the cavity is to be syringed out twice or thrice daily with an antiseptic lotion. A solution of bichloride of mercury (1 in 1,000) answers admirably. The patient should be told not to swallow the discharge.

Cysts of the antrum. — (*a*) A dentigerous cyst may encroach on the antral cavity, but this variety strictly belongs to cystic disease of the bone. (*b*) It is possible that occlusion of the opening by which the antrum communicates with the nose may now and then be the cause of accumulation of secretion, but, to say the least, it is seldom met with. (*c*) By far the most frequent origin of antral cysts is an obstruction of the mucous follicles. This is shown by the fact that cases occur in which the inner wall of the antrum presents a number of small cysts with pellucid contents. It may be that cysts of free formation in the submucous tissue develop now and then, but this view is gathered rather from a consideration of the history of cysts in general, than from well-authenticated observation of antral cysts in particular. (*d*) Cysts may be found in connection with solid growths.

Symptoms.—In addition to the feeling of tension there is the highly suggestive sign of bulging of the wall of the antrum. This almost invariably affects the part next the cheek, at any rate in the first instance. It is recognised by a rounded swelling of the face, and by the presence of a projection felt within the mouth. As the bone is thrust forwards it becomes much thinned and frequently perforated, so that firm pressure gives the sensation of *egg shell crackling.* This is also observed in some cases of solid antral tumour, so, whenever the diagnosis is at all doubtful, a trocar and canula should be thrust into the swelling. Neglect of this precaution might lead the surgeon into error, and be the means of subjecting the patient to an unnecessarily severe operation.

Treatment.—Open the cyst freely between the cheek and the jaw; drain, and wash thoroughly out. If there is much expansion of the bone a piece may be excised, or the attenuated wall may be crushed in by firm pressure with the thumb.

Tumours of the antrum and upper jaw.—In addition to the cysts originating in the antrum, the upper jaw may be the seat of (*a*) dentigerous cysts connected with retained teeth; (*b*) simple cysts, which probably have their starting point in disease of the teeth fangs; (*c*) cystic tumours, especially the sarcomata.

Polypi of the antrum.—Many growths springing from the wall of the antrum assume the polypoid form, but the chief varieties are soft fibrous, and mucous polypi. The former grow from the periosteum, the latter from the mucous membrane. Whilst they are yet small there are generally no symptoms. They may completely fill the cavity, and even project into the nose. Clinically the "soft fibrous" polyp is a sarcoma, and by its growth it expands the wall of the antrum. Naso-pharyngeal polypi may secondarily involve the antrum.

Treatment.—Make a free opening into the sinus, and extract the growths. It may be advisable in some cases to excise a portion of the bone to which they are fixed.

Epithelioma.—There are two forms of epithelioma of the upper jaw. (*a*) *Squamous*, which begins in the mucous membrane of the palate or gum. (*b*) *Columnar*, arising within the antrum. The latter is the rarer of the two, and its true nature cannot be diagnosed without a microscopical examination. The former presents the general clinical and pathological characters of squamous epithelioma, modified only by the density of the tissue in which it spreads. It is prone to ulcerate and form an irregular fungating mass which yields a fœtid discharge, and is very liable to bleed. The cervical lymphatic glands are sooner or later affected. Secondary growths in the internal organs are rare. The patient succumbs under the combined influences of septic absorption, hæmorrhage, and dyspepsia from inability to masticate food, and probably from the injurious effects of swallowing the decomposing discharges. Pneumonia, from the inhalation of septic matter, is a common occurrence.

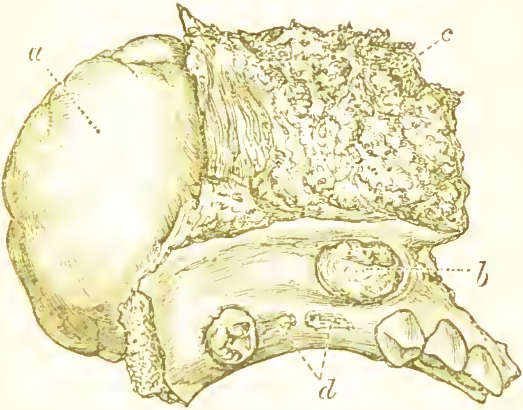

Fig. 11.—Fibro-Sarcoma growing from the Inner Wall of the Maxillary Antrum.

a, The growth; *b*, portion of the growth fungating through the mucous membrane at the junction of the jaw with the cheek; *c*, fat and other tissues of the face not affected by the growth; *d*, teeth sockets. The tumour, by its pressure, had caused absorption of the floor of the orbit and the hard palate. Suppuration occurred, and the diagnosis, for this reason, was, for a time, uncertain. (From St. Mary's Hospital Museum.)

Sarcoma affects patients of all ages, but it is chiefly met with in young and middle-aged adults. Every form may be observed, but the most common varieties are the round and spindle-celled, or a mixture of the two. Myeloid usually grows in the form of an epulis from about the teeth sockets. Central myeloid is not nearly so frequent as in the lower jaw. The tumour may undergo nutritive modifications; thus it may ossify, chondrify, or become studded with cysts of various sizes. I have seen one case of deeply pigmented melanotic sarcoma. It grew from that portion of the jaw which abuts on the nasal fossa and the antrum. As regards their malignancy, sarcomas of the jaws differ widely, *e.g.* one meets with a firm, spindle-celled tumour of slow growth, and with little tendency to recurrence after removal; whilst in a second case there is a pultaceous highly vascular mass which runs its course with appalling rapidity, so that within a few months the patient dies from the effects of the local disease and widespread dissemination in the viscera and other parts. The so-called "vascular tumours" are in reality soft sarcomas richly supplied with blood-vessels, and in fact largely composed of them.

Fibroma occurs in two situations, (*a*) within the antrum; (*b*) attached to the periosteum of the gum (fibrous epulis).

Enchondroma is rare to a degree. It may form the main bulk of the growth, but as a rule it is combined with round or spindle-celled sarcoma. In fact, enchondromata of the jaws are for the most part chondrifying sarcomas. The recurrent growths are softer and contain fewer cartilage elements than the primary tumour.

Osteoma is more common in the lower than in the upper jaw. There are two varieties marked respectively by the cancellous or ivory-like structure of the new-formed bone. There is some doubt whether "*diffuse hypertrophy* of the bones of the face," including the upper jaw, should be considered with the tumours proper or be relegated to chronic inflammation of bone. Its affinities appear to me to belong rather to the former, for it develops irrespective of injury or known constitutional disease. It belongs to the periods of childhood, youth, and early adult life, and it is utterly unamenable to treatment. The bones become "spongy, puffed, nodular" (Billroth).

Diagnosis of tumours of upper jaw and antrum.—On account of the complicated anatomy of the maxilla the diagnosis of the different forms of new growth is often beset with difficulties. This applies with greatest force to tumours of the antrum, where, in the early stages, mistakes may easily be made. The surgeon should, in the first place, ascertain whether the tumour is solid or fluid or a combination of the two. The answer to this will often give a clue as to whether the growth is simple or malignant. Malignant growths are further indicated by rapidity of increase, early bulging of the antral walls, implication of the soft parts with ulceration and fungation, and, lastly, by the evidence of cachexia and secondary formations. The lymphatic glands are usually affected in the carcinomata, occasionally in the sarcomata.

The primary seat of the growth will lend some aid to the diagnosis; *e.g.* a tumour attached to the alveolus is probably a myeloid or fibrous epulis, or an epithelioma. Distension of the antrum is suggestive of a cyst; but on the other hand it may be caused by a solid growth. Again, it is important to ascertain not only whether the tumour has started from the antral walls, but whether it is confined to the cavity. The treatment and the diagnosis turn largely on the answers to these queries.

Treatment of tumours of the maxilla and antrum.—In the case of a simple growth it is sufficient to remove it, together with its base of attachment. When the antrum is involved the precise operation will depend upon the size, nature, and connections of the tumour. Thus, the extirpation of a simple polypus may be effected through an opening made into the cavity from within the mouth. Larger growths, and especially those connected with the naso-pharynx, or pterygoid region, require removal of the jaw, or "osteoplastic section" as advised by Langenbeck. The latter procedure consists in temporarily displacing the jaw to give room for the necessary manipulations. Unless the entire tumour can with certainty be removed an operation is worse than useless; nor should it be attempted when the surrounding lymphatics or the superjacent skin is widely infiltrated. The mere fact of the skin being involved is not a contra-indication. I have removed the entire jaw with one side of the nose and a portion of the cheek for a round-celled sarcoma, and which, after the lapse of two years, has not recurred. In the case of malignant growths the only alternative to an operation is leaving the patient to endure terrible suffering and certain death within a short period. Enlarged lymphatic glands may be extirpated if they are not massed together and adherent to the deep structures; *e.g.* the carotid sheath.

Tumours of the lower jaw.—The tumours of the lower jaw are the same in kind as those met with in the upper. There are some, however, which occur with greater frequency in the former situation; *e.g.* cysts, either as a substantive disease or in combination with solid growths, central myeloid sarcoma, and epithelioma or adenoid cancer.

Cysts.—The body of the lower jaw may be expanded by a *simple cyst*, which "originates in connection with a tooth, but the mode of whose origin is not very clear" (Erichsen). Occasionally a small *pedunculated cyst* is found attached to the fang of a tooth, and it seems highly probable that the larger cysts are primarily of this nature, and that they are the result of chronic inflammation of the periosteum of the tooth fangs.

Multilocular cysts are produced by cystic degeneration of solid tumours, sarcomas, and epitheliomas. Multilocular sarcomatous cysts are frequently associated with development of bone in the interior of the growths, and after maceration the osseous framework may show the general structural arrangement as it existed in the recent state.

Dentigerous cysts develop in connection with a retained and frequently misplaced tooth, which almost always belongs to the permanent set. They are most common in youth and early adult life. The contents are believed to be formed within the enamel sac. The greater part of the jaw may be expanded into a large hollow shell. The tumour has been mistaken for a solid growth. To prove its nature always puncture before operating.

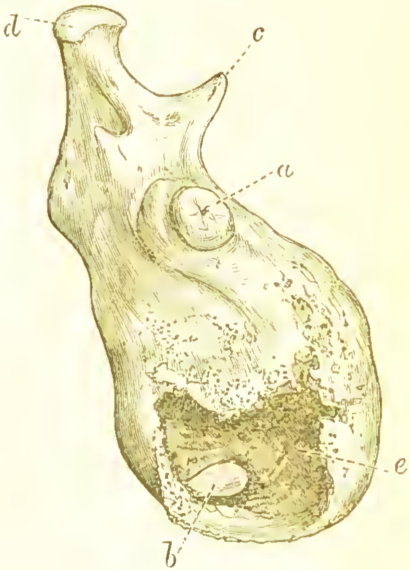

Fig. 12.—Dentigerous Cyst of Lower Jaw.

The left side of the body of a lower jaw expanded with a large cyst, to the inner wall of which a retained canine tooth is attached. The cyst was lined with a thick vascular membrane composed of granulation and fibrous tissue, and showing no trace of epithelium. From a girl, aged 13. (No. 2,195, Royal College of Surgeons Museum.)

a, Molar tooth; *b*, tooth in cyst; *c*, coronoid process; *d*, condyle of jaw; *e*, cavity of cyst.

Treatment of mandibular cysts.—Lay open the cavity. If it is a large one excise a portion of the cyst wall and try to crush in the remainder. Extract the tooth from a dentigerous cyst.

Epithelioma of the lower jaw is sometimes only a phase in the life history of an ordinary epithelioma, which springs from the gum or lip. But many of the tumours which were formerly believed to be sarcomas are now known to consist essentially of epithelial elements. In these cases the growth tends towards the interior of the bone so that it is more or less rounded in outline. It may assume considerable proportions before it ulcerates or fungates. On section it is frequently observed to be cystic and lobulated, as shown in the accompanying figure. The epithelial cells are, for the most part, round or polygonal, whilst the peripheral cells are sometimes columnar. Colloid degeneration causes the cells to melt away, hence the formation of cysts. The epithelial cells are generally arranged in regular columns or groups, presenting a distinctly adenoid character; in fact, the tumour is

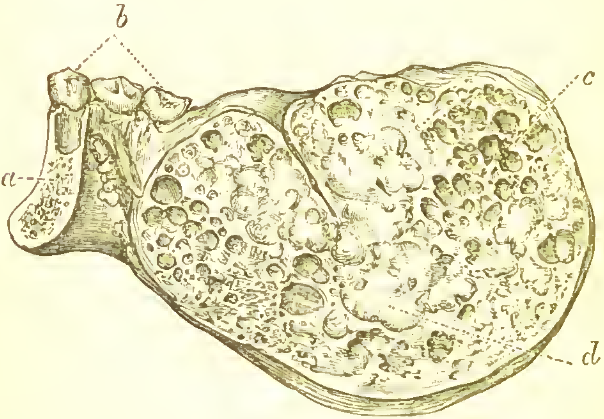

Fig. 13.—Cystic Epithelioma (Adenoid Cancer) of the Lower Jaw.

a, Divided bone: *b*, teeth; *c*, cysts containing a glairy fluid: *d*, lobules of the growth. For microscopical characters *vide* Pepper's "Surgical Pathology," Fig, 5, p. 112; 2nd ed. (From St. Mary's Hospital Museum, A*d* 67.)

often spoken of as "adenoid cancer," or even an "adenoma." The intercolumnar bands are composed of fibrous tissue, or of long spindle-shaped cells. The growth probably originates in the epithelium of the gum, possibly, in some cases, in the remains of the enamel organ of the teeth. This variety of epithelioma is not so malignant as the squamous form, which develops so largely as an outgrowth.

Central myeloid sarcoma grows from the medullary tissue between the inner and outer plates of the jaw, which it expands into a thin shell of bone. The latter may yield or break on pressure, giving a crackling sensation. The other kinds of sarcoma may be central, but, as a rule, they are periosteal.

Enchondroma and *osteoma* have been already referred to. In the College of Surgeons Museum is a fine specimen of a large ivory osteoma attached to the jaw. Osteoma, pure and simple, is far from common. Ossifying sarcoma occurs with much greater frequency. "Enchondromata of the jaws are amongst the mirabilia of surgery." They are usually associated with sarcoma.

The *diagnosis* and *treatment* of tumours of the lower jaw are carried out on the same principles as in the case of the upper, *q.v.* Growths confined to the alveoli and their vicinity may often be removed without making an external incision. If the tumour is malignant divide the bone wide of the disease.

Neuralgia of the jaws may be of central origin, or it may be caused by the pressure of a tumour, or by ossific deposit, especially in the inferior dental canal. When of local origin the treatment consists in removing the cause. In some cases "nerve stretching" gives relief. I have excised a portion of the infra-orbital nerve for inveterate neuralgia of the jaw with complete success.

IV. DENTAL SURGERY.

HENRY SEWILL.

Dental caries.—Dental caries is a process of disintegration, commencing at the surface, and due to external agents. The agents in initiating caries are acids, the products of chemical change and fermentation set up in fragments of organic matter (food, mucus, and epithelial scales) which are lodged about the teeth. These acids are often assisted in their action by acid mucus secreted by unhealthy gums, acid saliva in some diseases, and acid eructated from the stomach in others. When the dentine is reached, the acids are assisted by the proliferation in the fibrils and organic basis of that tissue of organisms, consisting of micrococci, oval and rod-shaped bacteria, and a fungus (*leptothrix buccalis*). The physical signs of caries (discoloration and softening of the tissues) bear a general resemblance in every case. They differ only in consequence of the mode of onset, the situation, and rapidity of the disease, giving origin to such terms as "spreading," "penetrating," "soft," or "hard" caries. The discoloration in the incipient stage on an unbroken surface of enamel usually amounts to no more than slight opacity of that tissue. When the disease begins in a fissure, and when a cavity is formed, the discoloration is more marked, the softened dentine assuming a brown tint, or becoming stained to a blackish hue. Cavities in which the disease is progressing rapidly show least discoloration.

When a surface of enamel is affected it appears eroded, rough and full of small holes, and is readily scraped away by a steel instrument. When the mischief has commenced in a fissure, little softening may be apparent for a time at the surface, but later the undermined enamel, breaking down, discloses a cavity in the dentine filled with débris and decalcified tissue. Such a cavity is formed in every case in the later stages. The enlargement of the cavity in the deeper parts is due to the fact that organisms flourish most in the dentine, in the organic basis of which they find their pabulum.

The predisposing causes of caries are: first, innate structural defects in the teeth which render them more susceptible to the action of agents. Caries may commence on a sound unbroken surface of the tooth, especially on the lateral aspects, where the shelter afforded by the chinks between the adjacent teeth allows decomposing foreign particles to remain undisturbed for lengthy periods; but more frequently it has its starting point at some part of the enamel and dentine, the seat of structural defect, from which few sets of teeth are altogether free, and when it penetrates to a mass of ill-calcified dentine the disease advances with great rapidity. Secondly, all diseases accompanied by vitiation of the oral secretions, from the occasional foul tongue and clammy mouth accompanying an attack of dyspepsia, to the severe condition associated with the zymotic fevers, such as small-pox or typhoid. The liability of pregnant women to suffer from dental caries is mainly due to vitiation of the oral secretions which frequently accompanies that condition. Thirdly, crowding and irregularity of the teeth, due to smallness and malformation of the maxillæ. These conditions make certain the accumulation of decomposing foreign particles in the unnaturally narrow interstices between the teeth, and in the nooks and crannies formed by the irregularities.

Symptoms.—Enamel being devoid of sensibility, pain during caries does not begin before the dentine is affected, and it is due at first solely to the exposure of this tissue to sudden changes of temperature and contact with irritating substances. In the later stages more severe pain arises from irritation and inflammation of the pulp, when insufficiently protected by a layer of dentine, or actually exposed. Finally, there becomes added the pain due to extension of inflammation from the pulp to the peridental membrane. The amount and character of the pain in all the phases of caries are much diversified in different persons. In some there is constant pain of a dull, aching character, augmenting from time to time, as decay advances, into severe paroxysms, whilst in others the teeth are destroyed without any suffering beyond slight occasional pain and uneasiness. It is impossible to account for this difference; but it may be noted that the very young suffer, as a rule, more acutely than adults or the aged, and that in certain conditions of health, of which pregnancy furnishes the most striking instance, toothache, if it occurs, is usually of the severest kind.

Treatment.—Much can be done to prevent caries by maintaining perfect mechanical and chemical cleanliness of the mouth, by use of tooth-brush and tooth-pick, with antiseptic tooth-powders and lotions.

The treatment of incipient caries of contiguous surfaces of incisors and canines, where the decay does not penetrate beyond the enamel, may be confined in many instances to filing away the diseased tissue, polishing the surface, and leaving it of such a form that it may be readily cleansed, and not allow the adhesion of decomposing particles of food. Except in these few cases, caries must be treated by the operation of plugging or filling the tooth. This operation comprises cutting out the diseased tissues, removing fragile and overhanging margins, shaping the cavity for the retention of the filling, and filling it with some suitable material.

Inflammation of the pulp.—This, the commonest affection of the dental pulp, may supervene as the result of exposure from fracture of a tooth, but its most frequent cause by far is caries. It may be either acute or chronic. Pain is the most prominent symptom of acute inflammation. At the commencement it is dull and aching, confined to the affected tooth; but soon assuming a more intense, lancinating, or throbbing character, it appears to spread to the adjoining teeth, and to the whole side of the head and face. The pain of this form of toothache is more severe than in any other dental disease, and is accounted for by the fact that the pulp, a highly vascular and nervous substance, is confined within the rigid walls of a chamber where swelling is impossible, and whence the inflammatory exudations cannot freely escape. Inflammation of the pulp may be distinguished from dental periostitis by the fact that in the latter the earliest symptom is tenderness upon pressure and slight elevation of the tooth in the socket, whilst in the former these symptoms are not displayed until a later stage, when inflammation has extended to the periosteum. When the pulp cavity is but slightly opened, or where the pulp is confined beneath a layer of dentine, or beneath a filling, there being no room for swelling, and little or no escape for the inflammatory exudations, such constriction may be produced as at once to cause death of the whole mass. An attack of acute inflammation is, however, usually limited to the exposed surface alone, and slowly subsides, assuming, perhaps, a chronic form. In chronic inflammation the pain is usually of a dull, aching, or gnawing kind; it may be altogether absent if there be free vent for exudation, or be manifested only at a distance, in a neuralgic form.

Treatment.—A vast number of teeth are extracted for the relief of pain from inflammation of the pulp: but a large majority of these teeth could be saved by proper treatment. This consists in destroying the pulp by means of arsenic, extirpating it, plugging the pulp cavity with antiseptic material, and stopping the tooth.

Dental periostitis.—Inflammation of the dental periosteum may be confined to one or two teeth, or may involve many or all the teeth. The former variety is most common, the usual cause being extension of inflammation from the dental pulp. Periostitis often arises after the filling of a cavity in which portions of a suppurating or decomposing pulp have been left, and in which matter penetrates to the depths of the root canals, and sets up irritation. It may also result from injuries of the teeth or alveoli, or may arise from rheumatism, syphilis, or scurvy, or cold, or the effects of mercury; whilst, finally, certain cases of general subacute or chronic periostitis (pyorrhœa alveolaris) with absorption of the alveoli, frequently occur, in which the cause cannot be ascertained.

The *symptoms* of acute periostitis commence with a feeling of uneasiness, which increases in the course of a few hours into aching pain accompanied by tenderness of the tooth, especially when pressed into the socket. The pain becomes severe and the tooth is evidently protruded, and loosened owing to swelling of the lining membrane of the socket. The neighbouring teeth become tender, the inflammation involves the gum and spreads to the palate and cheek, which become swollen and œdematous, the œdema often extending to the eyelids when an upper front tooth is the centre of the disease. At this stage suppuration takes place, pus is formed, points, and finds its way to the surface, and this is followed at once by diminution of pain and by slow subsidence of all the symptoms. The acute stage of such an attack lasts from three to ten days. Recovery may take place, the inflammation may remain chronic, it may end in necrosis of the tooth, or spreading to the jaw may cause necrosis of bone.

The treatment must be governed by the cause of the disease and other circumstances; most cases yield to treatment. If it be resolved to save the tooth, the cavity of decay and the pulp must be dealt with; the gums at the onset may be painted with a mixture of equal parts of tincture of iodine and tincture of aconite. Local bleeding and warm fomentations within the mouth are of the first importance in the next stage of the attack. So soon as the swelling occurs, incisions should be made through the gum down to the bone at the position where it appears probable that matter may form, whilst at the same time the warm fomentations are persevered with.

Chronic dental periostitis may arise from any of the causes which originate the acute form of the disease. Periostitis due to constitutional causes usually affects several or all of the teeth of one or both jaws, is generally chronic, and rarely passes at all beyond the subacute stage. The symptoms comprise in a modified degree those present in acute inflammation. The teeth are tender on pressure, are the seat of a varying amount of pain, are more or less loosened and raised from their sockets, and they are surrounded by swollen gum. On pressing the mucous membrane in some cases either pus or muco-purulent matter oozes from around the necks of the teeth. These symptoms may continue for months or years, until the teeth, becoming completely loose, in consequence of absorption of the alveoli, are at last lost.

The treatment will consist in removing the cause of the disease. When the inflammation is associated with the disease of the pulp, that structure must be dealt with. Sources of local irritation, such as tartar deposited upon the necks of the teeth or necrosed roots, must be removed. Blood may at intervals be abstracted by incising deeply with a scalpel the swollen gum between the teeth. When the gum is separated from the necks of the teeth, and a purulent discharge is poured out, the part should be swabbed frequently with a solution of chloride of zinc (twenty grains to the ounce) by means of a small probe and a pellet of cotton wool passed beneath the free edge of the gum. Detergent lotions may be used to overcome the fœtor of the breath. In periostitis due to constitutional causes, attention must be directed to the general health.

Alveolar abscess.—This class of abscess, seen in its most familiar form in the ordinary "gum boil," consists of a collection of pus between the gum and the bone, external to the root of the tooth from which the disease originates. In severer cases the matter, if it do not find a ready exit into the mouth, may point and burst externally. This termination, although it occasionally supervenes upon suppuration around other teeth, much more commonly follows abscess connected with lower molars. Suppuration in alveolar abscess always commences in the socket at the surface of the tooth, but as soon as matter forms it finds its way into the surrounding tissues. Abscesses connected with diseased teeth are usually traceable without difficulty to their origin. The matter does occasionally, however, burrow through the soft tissue, and appear about the palate, cheek, or jaws, in situations so unusual, that the relation of the discharge to the teeth is not at first sight suspected. In cases of abscess about the mouth or face, the origin of which is not evident, it is, therefore, desirable that an examination of the teeth should be made. When the matter escapes through the cheek, the symptoms closely simulate necrosis of the jaw.

The treatment of alveolar abscess is really the same as that of dental periostitis, of which it is but a phase. When pus is forming, poultices and warm applications to the cheek should be avoided, as they encourage the escape of matter through the skin. Most cases either yield to treatment or subside after running a certain course; but the progress of the disease may be, as a rule, at once arrested by the extraction of the tooth, an operation which may be performed without hesitation when the tooth is useless owing to chronic disease or extensive decay, or when the abscess threatens to burst externally. Abscesses, or fistulous tracks, opening externally, must be treated by dressing and syringing with solution of carbolic acid, 1 in 40, or with eucalyptus oil. In cases where no dead bone exists, such treatment, with the extraction of the tooth, which in these cases is always called for, rarely fails to bring about a rapid cure.

Toothache is a symptom, not a distinct disease. It is most commonly caused by caries and the sequelæ of caries. Diseased teeth, which do not themselves ache, and particularly teeth the seat of chronic inflammation of the pulp, excite pain in many cases in neighbouring or in distant teeth. In other similar instances it is due to diseased roots or to impacted wisdom teeth. Toothache accompanies chronic wasting of the alveoli. In rare cases it is due, to calcification of the pulp in teeth with no external sign of disease. It may be due to true neuralgia. Toothache in the vast majority of cases is due to a local cause, although this is often not discoverable except by careful minute examination of all the teeth. The treatment consists in dealing with the cause by appropriate measures.

Syphilitic teeth.—It by no means happens that every case of inherited syphilis is marked by typical mal-development of teeth; in most cases no characteristic defect appears. Syphilitic teeth are mostly accompanied by other evidences of the taint, especially by skin affections and interstitial keratitis; and as many honeycombed and defective teeth closely resemble syphilitic teeth, great caution is necessary in pronouncing a diagnosis from the evidence of the teeth alone. The central permanent incisors are most commonly the seat of the characteristic sign, but the laterals and canines may also be affected. The teeth are of bad colour, narrow, short, and peg-shaped; the angles being much rounded. The points are ragged, with usually a vertical notch extending towards the gum in front and behind. Horizontal notches and fissures often exist also on the same teeth. (*See* Art. XXII., vol. i.)

Honeycombed teeth.—This defect is most common in the first permanent molars, and in the incisors and canines, the bicuspids being rarely affected. The enamel is full of small pits, and the teeth are often marked by horizontal grooves. The cusps of the molars have a pinched, elongated shape, and the edges of the incisors are thin and flattened from before backwards, the enamel towards the neck being often normal.

Extraction of teeth.—During the operation of extracting teeth, the patient may lie upon a low couch, with the shoulders raised upon pillows, and the head thrown back in a good light, the surgeon standing sometimes on the right, sometimes a little behind the patient's head. This position will serve for any tooth. In removing teeth of the lower jaw, the patient may be seated on a low stool, with the head either firmly grasped between the operator's knees, or held by an assistant, the surgeon in the latter case standing in front or at the side. The instrument is held in the right hand, whilst the left hand, fingers, and arm are employed in steadying the head, grasping and fixing the lower jaw, drawing back the commissure of the lips, and assisting to direct the instrument. The instruments employed almost exclusively are forceps of various patterns, adapted to fit the various classes of teeth, and to grasp without crushing them. Their edges are sharp, so that they may be readily insinuated between the free edge of the gum and the neck of the tooth, and forced towards the socket. The operation consists of two distinct actions: firstly, the seizure of the tooth; and secondly, the loosening of its connections and its withdrawal from the socket. It is upon the careful performance of the first step of the operation that its success in the main depends. The forceps is lightly applied to the neck of the tooth, and forcibly pushed along the root, enough force being exercised to drive the blades of the forceps well round the root within the edge of the alveolus, and it is rare for the removal of a tooth so grasped to present any difficulty. The grasp is now tightened, and the next step of the operation is proceeded with. As the tooth yields, the forceps is pressed deeper, so as to embrace the tooth deeply within the alveolus, and to avoid breaking off the crown. In the second stage of the operation the method of applying the force is modified with each class of tooth, the roots varying in number, position, form, and size, and the investing bone offering less resistance in some directions than others. This stage of the operation, although distinct from the first, is really continuous with it, the whole being effected with one even movement. It may be performed rapidly by a practised hand, but an attempt to wrench a tooth from its socket by force, either wrongly directed or indiscriminately applied, will in most cases result in fracture of the tooth, and may also inflict severe injury upon the jaw and surrounding parts. The upper incisors and canines have conical roots, and their extraction is accomplished by rotating them the slight degree necessary to loosen them, and pulling them downwards and a little forwards. The upper bicuspids having roots flattened laterally cannot be rotated. They are loosened by forcing them steadily outwards, then moved to and fro from within outwards, and pulled downwards. Two forceps are required for the upper molars: one for the right, one for the left. The outer blade is formed in two curves, to contain the external roots; the inner blade to grasp the internal root. The force is first applied in the outer direction, for the reason that the external alveolar plate offers less resistance than the inner, while the direction of the palatine root is such that it is likely to be snapped in an attempt to move the tooth inwards. As soon as the tooth yields it is moved from side to side, and pulled downwards. The upper wisdom teeth are extracted in the same way as the upper molars, and ordinary molar forceps may be used, but they are more conveniently reached by an instrument specially curved to pass to their position at the extremity of the jaw. The lower incisors are loosened by bending them forwards, and detached by a to and fro movement from within outwards, combined with an upward pull. The lower canines having somewhat conical roots, are loosened by a rotatory movement, and drawn by an upward pull. The lower bicuspids, having roots flattened laterally, are extracted by forcing them outwards until they are felt to give, then moving them from side to side and at the same time drawing them upwards. In applying the forceps to lower teeth, the point of the thumb of the left hand may be placed over the joint of the instrument whilst the fingers press the jaw upwards from beneath. In this way the forceps is guided in the desired direction, power is obtained to drive it home, and the instrument is prevented from coming into violent contact with the upper jaw at the moment the tooth leaves the socket, whilst at the same time the danger of dislocating the jaw is guarded against. The lower molars are loosened by force directed first in an outward direction, then moved to and fro from within outwards, and pulled upwards. Should the tooth offer great resistance, a backward and forward movement is adopted to free the roots, which are curved more or less in the backward direction. The extraction of these teeth, and any lower tooth, is much facilitated by firm fixation of the lower jaw, the left hand of the operator being used to firmly grasp the chin and press the jaw upwards and backwards; or this may be done by an assistant. The lower molars are the only teeth which commonly call for the exercise of great force in their removal; and occasionally this will try the strength of a powerful hand. As it is impossible to discover the amount of resistance in any case until the operation is commenced, it is well always to be prepared with a reserve of power; and this is to be obtained by having the patient seated low, the lower jaw firmly fixed, and employing either "hawk's bill," or American pattern forceps, in which additional leverage is obtained by the blades being at an angle to the handles. The lower wisdom teeth are extracted by the same method as the other molars.

Extraction of the roots of the single-fanged teeth of both the upper and lower jaws is carried out on the principles already described; that is to say, the forceps is steadily pushed along the root and a sufficient grip upon a sound portion obtained before an attempt is made to complete the operation. As the root yields, the thrusting of the instrument deeper may be continued, and by giving the forceps at this time a slightly rotatory movement, the blades are made to penetrate more readily. When the root is extensively decayed or broken within the alveolus, forceps are used with smaller and more slender blades, in order that they may be more easily passed into the socket and insinuated between the root and the surrounding bone. In extracting the roots of molars, the procedure is guided by the extent of the decay. If the roots are firmly united together they may be removed by the ordinary tooth forceps, great care being taken to insinuate the blades of the forceps along the roots until a firm grip is obtained, and to thrust them deeper as the root yields. Where it appears difficult to obtain a sufficiently deep hold with the ordinary instruments, forceps may be employed provided with long and sharp-pointed blades, which are either thrust into the alveolus, or forced through the alveolar plate. In those cases in which the roots of the molars are detached from one another by decay, or so slightly united as to preclude the possibility of their removal in a mass, they must be extracted separately by means of root forceps. The roots of the upper teeth, being conical, may be detached by a rotary movement; those of the lower, owing to their flattened shape, require a rocking movement from within outwards. Roots which are so deeply buried in the socket as to be with difficulty reached with the forceps, may be extracted with the elevator. In applying the elevator, the blade is thrust deep into the socket, along the root, until a solid surface is reached. The handle is then turned, so that the point of the blade impinges upon the root, and by a levering movement presses it from the socket. In this procedure the fulcrum is necessarily formed altogether, or to a great extent, by the alveolar wall, or by the adjoining tooth, and as the force exercised by the elevator is very great, unless care be taken the former may be extensively fractured or the latter dislodged. The elevator should be, therefore, firmly grasped, the fingers reaching close to the blade. The thumb and fingers of the left hand may in some instances serve partly or entirely as a fulcrum, and in every case they should be employed in guiding and supporting the instrument and controlling the force. The elevator should not be, as a rule, inserted between the external alveolar wall and the root, this part of the bone being too thin to stand much pressure ; and it should never be used for the extraction of upper wisdom teeth, the bone around these teeth being weak and readily fractured. Roots, the crowns of which have been long decayed away, are seldom difficult to extract ; but recently and deeply-broken roots, especially in places, as with lower molars, where the bone around is dense and unyielding, call for great skill and caution, lest injury be inflicted on the jaw. Occasionally difficulties arise in consequence of irregular formation of the roots. They may be so curved or, in the molars, so spread, as to require more than ordinary force to remove them ; indeed, the roots are sometimes so placed in the jaw that it is impossible to remove the tooth without snapping one or more of the roots or breaking a portion of the alveolus. If unusual resistance be met with, an abnormal arrangement of the roots may be suspected. Such being the case, the operator must proceed cautiously and deliberately to overcome the obstruction ; and as it is impossible to ascertain the precise form of the irregularity, it will be found safer, in applying extra force, to follow the directions given for the extraction of a normal tooth. In spite of due care, it will happen sometimes that a portion of a root is left in the socket. The broken piece is commonly loosened, and may be picked out with the root forceps or elevator; but, should a fragment of the apex of the fang remain fixed in its original position, it is in many cases better to leave it rather than to inflict the injury upon the bone which its withdrawal would entail. It rarely gives rise to irritation, and in due course the changes which take place in the surrounding bone lead to its loosening or expulsion. The separation of a small portion of the alveolar process during extraction, which is sometimes inevitable where the roots are twisted, is a matter of no importance.

Hæmorrhage after extraction.—The hæmorrhage which follows the extraction of teeth, in most cases, is slight, and continues but for a few minutes. Occasionally, however, oozing goes on for a considerable time, whilst in rarer instances the flow is so severe as to require active measures for its arrest. The bleeding may be due to a hæmorrhagic condition of the patient, or may result from laceration of an artery situated in abnormal proximity to the root; but capillary vessels may, after chronic periostitis, become enlarged, so as to pour out, when lacerated, a considerable stream. It occasionally happens that hæmorrhage, which has ceased, recurs after an interval of hours or days. Slight hæmorrhage may be usually arrested by cold, the mouth being freely rinsed with iced water. Should the flow persist, or should it be copious or arterial in character from the first, the alveolus must be at once firmly plugged. The clots having been removed by syringing with cold water, a narrow strip of lint or a twisted rope of cotton is tightly packed into the alveolus with a blunt probe, fold upon fold, care being taken to pass it to the bottom of each division of the socket. A compress of lint is then placed in position, and pressure is kept up by causing the patient to bite forcibly upon it, and fixing the jaw by a bandage passed over the head and beneath the point of the chin. The plug, which often gives rise to considerable irritation, may be withdrawn after the lapse of twenty-four to forty-eight hours. Instances are extremely infrequent which call for other treatment, which would consist in the application of styptics, of which the best is perchloride of iron. This application excites inflammation, and should therefore be used only in severe cases. In cases which resist this treatment, the actual cautery may be resorted to, the iron being used at a black heat.

Fracture and dislocation of teeth.—Fracture of the teeth may arise from injury, such as a blow upon the mouth, or when a fragment of bone, a small gritty particle, or a shot in game is bitten upon. If the fracture do not lay open the pulp cavity, it will often suffice to file down the rough surface and carefully polish it. In other cases, if the fractured surface is of such a shape as to form a cavity, or so situated that this appears desirable, a filling may be inserted. If the pulp be exposed and the fracture extend into the root, the extraction of the tooth will be called for; but if the fracture involve only the crown, an attempt may be made to save the tooth, or at least the root. The pulp in most cases must be at once destroyed, after which fang-filling may be performed, or an artificial crown may be attached to the root.

Dislocation of the teeth, and more particularly front teeth, is not an uncommon effect of blows upon the mouth. A sound tooth may be dislocated during the extraction of a decayed neighbour, even where great care is exercised, when, in consequence of the smallness of the jaw, the teeth are crowded and closely impacted.

If partly dislocated the tooth must be pushed back into the socket. In complete dislocation, if the case be seen within a few hours, the tooth may be replanted. The socket should be first washed out with syringe and warm water, to clear it of coagulated blood, and the tooth, having been also cleansed, should be replaced in the socket and firmly pressed home. If care be taken to support the tooth by ligatures, and to guard it from injury, it will in favourable cases regain its attachment, and remain firm for years. After this treatment, as also after replacement of a partly dislocated tooth, acute dental periostitis may supervene, and this must be treated as described elsewhere.

Odontomes. — Under this name are classed several varieties of malformed and monstrous teeth, and tumours composed of confused masses of dental tissues. Their etiology has not yet been clearly made out. At an early period of development the teeth are represented by soft tissues. During this stage of growth the formative elements may become the seat of partial or general hypertrophy, atrophy, or other morbid action, followed by more or less complete calcification. The morbid process may be confined to the enamel organ, or to the dentine pulp, or may involve all the tissues of the tooth. Sometimes with hypertrophy of the tissues of the crown there is found arrest of development of the root; on the other hand, the crown of the tooth may be normal in form, whilst the root is abnormally large, and composed of a confused mass of dentine and osseous tissue (cementum) enclosing a vascular structure; or the odontome may consist of an irregular mass of dental tissues, without any definite arrangement, and bearing no resemblance to a tooth. Still another variety of tumour having the same origin is mainly fibrous in structure, containing only scattered spots of calcification. Odontomes are usually encysted, having no attachment to the surrounding structures, except such as may have arisen from inflammatory adhesion, and do not necessarily give rise to irritation or disease. Should they, however, constitute a deformity, become a source of irritation, or the centre of inflammatory action, they must be removed. Their extraction can be accomplished in some cases by means of an ordinary tooth forceps; and, should it be necessary, the bone may be divided by the bone forceps to facilitate the operation. The fibrous variety may be removed by similar means. The cyst having been laid open, the mass may be turned out with the handle of a strong scalpel. Odontomes of considerable size are occasionally met with, so that in all cases of tumour of the jaw of doubtful diagnosis exploratory incisions, within the mouth, if possible, ought to be made to ascertain the true character of the disease before a formidable operation like excision of the jaw is proposed.

& WEST-RIDING
CHIRURGICAL SOCIETY

V. INJURIES AND DISEASES OF THE ŒSOPHAGUS.

John Croft.

Wounds of the œsophagus.—These may be divided into (*a*) those made from without inwards; and (*b*) those from within outwards.

The first class of wounds includes incised, punctured, and contused; they may be made by the suicide, by the homicide, by sword, bayonet, by fire-arms, or by the surgeon.

The second class may be due to accidental causes, as during the passage of a bougie, or by foreign bodies, or they may be made by the operation of internal œsophagotomy.

Rupture of the œsophagus may take place during vomiting, or as a sequence of malignant disease, or of stricture.

The symptoms must vary, as the wound of the tube communicates with the exterior or not. If, in wounds of the neck, the œsophagus has been opened, swallowing becomes impossible, and saliva with any food taken by the mouth appears at the wound.

The wound itself is at first pale, and covered with exudations; then granulations appear, and more or less complete cicatrisation ensues. It may heal completely or result in a fistula.

Wounds which do not communicate with the exterior, such as perforations or ruptures, give rise to much acute pain at the moment of infliction. Ruptures are marked by decided prostration, and even collapse, which may end fatally. The accident is attended by bleeding, and is soon followed by swelling, which may be accompanied by crepitation and emphysema. Deglutition is difficult, or even impossible. If the lesion is in the thoracic part of the œsophagus, abscess may form in the mediastinum, and pleurisy may occur. These wounds are not necessarily fatal; their progress and result depend greatly on their situation and extent.

These wounds are subject to such complications as beset wounds generally.

Treatment.—If practicable the edges of the wound should be brought together by sutures. The head should be kept flexed in order to favour cicatrisation. Feeding should be performed by the œsophagus tube. In some cases it may be necessary to leave the wound entirely at rest, and to feed the patient by the rectum.

Rupture of the tube seems to be beyond the reach of direct treatment. Feeding must be performed by the rectum.

Foreign bodies in the œsophagus.—These may reach the œsophagus in one of three ways, viz.: (*a*) by the mouth; (*b*) from the stomach; and (*c*) by wounds of the neck, as seen in military practice.

Owing partly to the construction of the tube, the foreign body may become arrested at the opening into the pharynx, or in the cervical division of its course, in its thoracic portion where it joins the stomach, or at an intermediate narrowed part opposite the third dorsal vertebra (left bronchus).

Symptoms.—When a large and firm body is impacted in the pharyngeal aperture or cervical part of the tube, the following symptoms will occur: a sense of suffocation, which may be paroxysmal; violent efforts at deglutition and retching; coughing and spitting; turgid congested face; starting eyes; lacrymation; anxious and frightened countenance; sweating and prostration. The patient may rapidly die asphyxiated. A body less in bulk, but irregular and sharp-pointed, gives rise to acute pain and sensations of pricking or tearing, blood-stained sputa, and some of the above symptoms, but in a less severe degree. Aphonia and wheezing have been observed. If the body is small, as a fish-bone, pin, or spicula of bone, there is proportionate dysphagia, increased by movement, pressure, and coughing.* Muscular spasm of the canal is sometimes excited, and even spasm of the laryngeal glottis.

Physical signs.—When the foreign body is in the cervical part of the œsophagus, and is of sufficient dimensions, it is within reach of one of three modes of exploration, viz. (*a*) palpation from the outside, (*b*) sight, or (*c*) touch by the finger in the mouth. The best and most satisfactory mode of examination is by the sound or bougie. The passage of the bougie or sound is of itself sometimes a mode of cure. The instruments commonly used are, first, a flexible whalebone blade, armed with an olive-shaped end of ivory or metal; and secondly, the bougie, made of gum elastic material; the former may elicit a sound or click. A sounding board or drum has been added to intensify the sound. It must be remembered that it is possible to pass the instrument by the side of the foreign body without eliciting any reliable indication of its presence. Auscultation has been employed as successfully to assist in discovering the situation of a foreign body, as in the diagnosis of stricture.

Prognosis and pathological anatomy.—If the foreign body has been lodged in the canal for a short time only, the lesion (if any) will probably be transient and trifling; but if the body has been such as to have caused punctures and lacerations, then more or less inflammation and ulceration will ensue, and these secondary lesions will cause corresponding pain and discomfort for ten days or a fortnight. When a rough body has been impacted for some days or weeks, the consequences may be numerous and serious; for example, inflammation of the coats of the tube, ulcerations, perforation, abscess, and periœsophagitis. If these processes end in cicatrisation, a stricture of an intractable character may ensue. The tube above the obstacle may undergo dilatation, whilst the part below it may contract.

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* Needles may travel through the tissues and appear after a long time at a distant part of the body.

Perforation, primary or secondary, of important structures along the course of the tube may lead to a fatal result, immediate or remote, as perforation of the heart, aorta, pericardium, trachea, pleura, or mediastinum. These perforations may occur by ulceration from close contact of the foreign body, or by consecutive abscess.

Treatment.—There are three different ways by which the foreign body may be removed: the first is by extraction through the mouth; the second is by pushing it on into the stomach; and the third is by œsophagotomy.

In suitable cases turning the body upside down may prove successful. The ejection of the body by vomiting is included in the first method. The act may be voluntary on the part of the patient, or induced by an emetic administered by the mouth or subcutaneously. When the body projects into the pharynx from the œsophagus, the surgeon can remove it by his fingers or by suitable forceps.

If the body is small and situated lower down, it may be extracted by one of the following instruments commonly in use, viz.: the coin-catcher; De Graefe's crochet, which is very similar; a probang armed at the end with a piece of dried compressed sponge; a probang furnished at the end with a snare of horse-hair; or the œsophagus forceps of various forms, devised for general or particular service. The probang can only be used when the foreign body is of such form and limited dimensions as to permit of the passage of the snare beyond it.

Forcible attempts at extraction may aggravate the lesions of the walls or even rupture them.

By propulsion: a bolus of food or foreign body which has passed as far as the thoracic part of the canal, may be gently and gradually pushed on until it passes into the stomach. It is unsafe to use force in this operation, for the mucous coat may be made to separate from its muscular coat, or the walls may be ruptured.

If all other means have failed to dislodge the mass from its position in the cervical part of the œsophagus, the next resort is to the operation of œsophagotomy. (*See* page 137 for Œsophagotomy.)

Malformations of the œsophagus.—Part of the œsophagus may be deficient; there may be a communication between this canal and the trachea, or one of the bronchi.

These errors in development may be met with in monsters, still-born infants, or in infants born alive and otherwise healthy.

Inability to swallow, or an attack of suffocation on attempting to swallow, should draw attention to the unfortunate state of the infant.

Non-malignant tumours of the œsophagus.—These, which are very rarely met with, are papilloma, fibroma, mucous polypus, adenoma, myoma. Instances of these have been at long intervals recorded.

The *symptoms* are uncertain and obscure. Dysphagia, retching, and inanition may lead to the discovery of their presence by the bougie.

Treatment.—If the growth be pedunculated, and if it be projected into the pharynx or mouth, it may be removed, as such growths may be removed from the pharynx.

Carcinoma and sarcoma of the œsophagus.—Primary malignant disease is not uncommon, but secondary growths in this situation are very rare. It is more common between the ages of fifty and sixty than earlier, and it is more often met with in men than in women.

The *epithelial* is the most common form of carcinoma. Other forms are rare, and the same is to be said of sarcoma. The parts of the tube most frequently affected are the upper and lower ends. The growth, which may be supposed to spread from a small centre, is very prone to ulceration, and to infiltration of the surrounding structures and glands. The aorta is less often invaded than the trachea, mediastinum, or lungs.

The progress of the disease is comparatively rapid, varying in duration from four to sixteen months. It may prove fatal by inanition, by hæmorrhage, by asphyxia, or by the consecutive affections of the lungs.

The *symptoms* are very similar to those of non-malignant stricture of the tube (*q.v.*). Localised, radiating, and reflected pains, one or all, may be complained of. When the obstruction is low down, more or less dilatation of the part above will take place. Regurgitations are then noticed, as in the more chronic obstructions. The breath is often offensive. Cough, dysphonia, and paroxysms of dyspnœa distinguish those instances in which the growth invades the respiratory tract from the upper ends. Thirst, delayed digestion, and constipation must also be mentioned. Emaciation and loss of strength progress more or less evenly, and with remarkable rapidity, and are accompanied by sensations of faintness. The new growth is sometimes manifested by external swelling and other physical signs. Tracheotomy may save the sufferer from sudden apnœa and assist in delaying the fatal termination.

The spontaneous breaking down and ejection of parts of the growth has been observed to temporarily relieve pressure symptoms.

Diagnosis.—In its early stage this form of obstruction has to be distinguished from spasmodic affections, cicatricial strictures, and extrinsic new growths or swellings. A medium-sized flexible bougie should be employed for exploratory purposes. Anything like living tissue brought out by the instrument should be submitted to microscopical examination.

Treatment.—When the disease is at the upper end of the tube, and at an early stage of growth, it may be extirpated by œsophagotomy. This offers the only prospect of cure. The surgeon has to fall back upon palliative treatment in all other cases. Alimentation offers the greatest difficulty. Milk, and peptonised or pancreatised fluid nourishments, ought to be prescribed or administered. Rest to an irritated œsophagus may be temporarily afforded by rectal feeding, or feeding by a permanent œsophageal tube. Where a small feeding tube can be passed and is tolerated, the alimentation can be carried on by means of it. The passing of a small tube once or twice a week assists to keep open the lumen of the constricted portion in suitable cases. Instruments are to be avoided when they cause bleeding. The best mode of administering sedatives is by subcutaneous injections. With the view of delaying the fatal issue, œsophagotomy has been performed when the growth has been situated sufficiently high in the neck to admit of this operation being performed below the obstruction. The results cannot be looked upon as encouraging. Gastrotomy has also been many times performed for this disease, and the same opinion must be given with respect to the results of the operation. Where the immediate results of these operations have been successful great relief has been given to the patient. He is relieved of all efforts at self-alimentation, from retching, from pangs of thirst and hunger, and from the immediate apprehension of impending death.

STRICTURES OF THE ŒSOPHAGUS.

Any diminution of the calibre of the canal is called a stricture.

Varieties.—Obstructions may be divided into, *first*, those due to organic changes in the coats of the tube; *secondly*, those due to compression of the tube from without; and, *thirdly*, those attributable to spasmodic affections. Those strictures or obstructions which belong to the first class may be subdivided clinically into those which are due to malignant new growths and those not so caused.

The causes (other than those due to malignant disease) belonging to the first class are chiefly referable to inflammation. It may be idiopathic, traumatic, or specific, or may be due to the results of such inflammations, viz. cicatrices after wounds by foreign bodies, burns, scalds, the caustic action of strong mineral acids or other fluid escharotics, or to past syphilitic and tubercular ulcerations of the mucous or submucous coats.

Simple new growths may cause obstruction, whether growths of the coats or of the glands in the mucous membrane.

Simple hypertrophy of one or other of the coats is also, but rarely, a cause of obstruction. Atrophy as an indirect cause of obstruction is rarer still.

The causes of the extrinsic class of strictures are such as tumours of the posterior mediastinum, aneurism of the aorta, glandular growths, abscess in the mediastinum, and foreign bodies in the trachea.

Cicatricial strictures are most often found in the upper part of the œsophagus. These may also involve the pharynx. They present various forms: annular, semilunar, long, short; or they may be flat scars around which the tissues are puckered and form valvular folds.

The stricture is generally single. It is less frequently observed at the lower end or at an intermediate part of the canal. Above this stricture the mucous membrane may become congested and inflamed, and ulcers and abscesses may form. In later stages abscess may open into the trachea, aorta, mediastinum, pleura, or lung.

Symptoms.—These, which are local and general, vary with the nature of the stricture and degree of closure of the tube. In malignant disease, the signs and symptoms advance more rapidly than in other forms of obstruction.

Dysphagia is one of the first symptoms, and is progressive, from hesitation in swallowing solid food to total inability to swallow anything that is not fluid. Regurgitation is noticed early, and is progressive from a slight degree of the act to true œsophageal vomiting. The time which elapses between the processes of swallowing and regurgitation, is roughly a measure of the distance of the obstruction from the mouth. The food is rarely returned as it was swallowed, but is mixed with mucus or streaked with blood, and, if it has been retained for more than a few minutes, it is in a putrescent condition. A turbid coffee-coloured discharge is generally indicative of cancerous disease. Pain: there is little pain felt at first, except in acute inflammatory affections. Later it may become severe and last after taking food. The locality of the pain and of the sense of obstruction afford a guide to the situation of the disease. The pain is sometimes observed to radiate from the œsophagus, and to be referred to between the shoulders and epigastrium. Food accumulates above the stricture and helps to cause dilatation with hypertrophy of the coats of the tube.

The general symptoms are wasting and debility. The wasting varies in degree and rapidity with the cause of the obstruction. In fibrous cicatricial strictures, the loss of strength and flesh is slow and gradual. In strictures of the thoracic part of the canal, an interval of time can be stethoscopically noted between the arrival of the fluid at the seat of contraction and its passage onwards towards the stomach. Palpation is sometimes of service in detecting stricture in the cervical region. The collection of food above the stricture may also occasionally be discovered.

The most trustworthy method of examining the œsophagus is by means of the bougie. Those bougies are best which are made of the same materials and shapes as the bulb-ended flexible catheters and bougies. The larger size should be tried first. The distance from the front teeth to the obstruction should be noted; the number, physical condition, and direction of the stricture should be estimated, and the presence or absence of dilatation ascertained.

Treatment.—Only the treatment of chronic obstruction due to causes other than malignant disease will be considered. The subject may be arranged under a very few heads, viz. rest, administration of nourishment, dilatation, internal and external œsophagotomy, and gastrostomy. It is only in exceptional cases that a cure can be accomplished. By rectal feeding and gastrostomy the physiological rest afforded the œsophagus in extreme cases has proved so beneficial as to suggest that the earlier enforcement of the principle is more desirable, though it may not be practicable.

Dilatation may be employed in three modes, rapid, gradual, or continuous. Of these the first is least practised. Conical graduated bougies of various sizes are made for the progressive mode, and tubes are made for the continuous mode of dilatation. For difficult cases flexible guides for the tubes are sometimes employed, but are not recommended.

The bougies should be graduated from No. 8 of the French gauge to No. 30. The larger sizes are rarely required. When the suitable instrument has been successfully passed it may be left in from ten to twenty minutes. It should not be passed more frequently than once in three days, and the size must not be too rapidly increased. In severe forms of cicatricial stricture, when the mucous membrane is very sensitive and irritable, rectal feeding should be adopted. After a few hours, or possibly days, of rest, the local condition has so far improved as to be more tolerant of instruments, and at the same time the stricture offers less resistance. If it has been difficult to pass the instrument, and the wasting of the patient is advanced, a tube should be substituted for the bougie and left in. The feeding is then to be conducted by means of this tube, which must be changed for a clean one every fourth day. A size not larger than No. 17 of Charrière's gauge is the best tolerated.

Internal œsophagotomy has been practised for this kind of stricture with the object of curing it, and with the view of facilitating treatment by dilatation. The mode of operating from above downwards has been abandoned as inefficient, uncertain, and unsafe. Cutting from below upwards is not looked upon with favour. It implies that an instrument can be passed through the stricture with facility. If it is open to treatment by the œsophagotome, it is also open to the treatment by gradual dilatation. The use of the cutting instrument has these additional objections, that in obstructions in the lower half of the canal there is no little danger of wounding vital structures, and that in long, dense, fibrous strictures the incision is insufficient. The safe use of this instrument is limited to short annular strictures in the upper part of the tube, where also gradual dilatation proves equally efficient and less perilous.

External œsophagotomy, or œsophagostomy, is reserved for those cases of impassable stricture limited to the upper part of the cervical region of the canal. It is obvious that the operation is only practicable below the stricture, and when that part is accessible on the neck.

When inanition is progressive the stricture is below the upper part of the œsophagus, and is impassable; then the only remaining resource is in the operation of gastrostomy. The operation is very often too long delayed.

Œsophagotomy.—External œsophagotomy is practised for two conditions: first, when a foreign body cannot be otherwise extracted; and, secondly, for cancerous or fibrous stricture of the upper extremity of the canal which is practically impassable.

The patient should be placed in the recumbent posture, the head and neck slightly elevated and extended, and the face turned towards the right side.

The external incision is to commence at the upper border of the thyroid cartilage, and to be extended downwards parallel with the anterior border of the sterno-mastoid muscle, towards the sterno-clavicular joint. The dissection is to be conducted carefully between the depressor muscles of the hyoid bone and the sheath of the great vessels of the neck. The omohyoid is to be drawn outwards or cut through; the thyroid body and trachea, with the muscles, are to be drawn inwards. The following parts are to be sought for and protected: the thyroid artery above, and the recurrent laryngeal nerve, where it enters the larynx, between the œsophagus and trachea. When the œsophagus has been reached a suitable sound may be passed by the mouth, if the œsophagus is permeable, and made to project its walls into the wound. The foreign body may prove a good guide. The opening into the canal should be small at first, then enlarged to admit a finger, and subsequently extended gradually, regard being had to the safety of the recurrent laryngeal nerve. If the operation has been performed for stricture, the incision may be extended through it. Silk sutures may be passed through the edges of the œsophageal wound to facilitate examination of the interior and the passage of the instruments. The object of the operation having been attained, the edges of the external incision should be attached to those of the wound in the œsophagus. It is not desirable to close the external wound. The patient is to be fed by a tube and with fluid nourishment.

The results of this operation, except when performed for foreign bodies, have not been encouraging. The percentage of deaths has been estimated at 59·37.

Gastrostomy is less unfavourable in its results, having yielded a mortality of 29·47 per cent.

Gastrostomy has for its object to form a complete fistula through the abdominal wall into the stomach, that food may thereby be passed into the organ.

The first operation was designed and performed by Sédillot, in 1849; the case ended fatally.

At the present period there may be said to be two modes of operating: by the first the operation is completed at one sitting; by the second method the operation is divided into two stages.

If the opening is to be made for obstructive disease of the œsophagus, it should be limited to about one-sixth of an inch in extent; but if made for the removal of a foreign body in the stomach, the incision into the organ must be proportionate to the size and shape of the foreign body.

The upper end of the linea semilunaris offers the best situation for the section of the abdominal wall in relation to the stomach, and it has been attempted to construct a contractile orifice in the edge of the rectus muscle.

It is most convenient to open the stomach at the part of the organ which can be drawn with least tension into the parietal wound, and this is generally somewhat nearer the pyloric than the cardiac end of it. For a similar reason the puncture is made a little nearer the lower than the upper border.

By proceeding in two stages, and by this means securing the union of the visceral and parietal peritoneum of the parts before opening the stomach, the peritonitis is restricted to the desired extent and quality.

The first stage or part of the operation may be subdivided into three steps: first, the incision through the abdominal wall; secondly, the finding and fixation of the stomach; and thirdly, the dressing.

The original crucial incision has been abandoned. Tho choice lies between the vertical incision between the outer fibres of the rectus, as advocated by Howse, and the curved incision below the lower border of the ribs. We will adopt the latter. This curved or oblique incision should be made about an inch below and parallel with the margin of the left ribs. In length it should extend about an inch and a half on each side of the linea semilunaris. The skin, muscles, and fasciæ are to be severally and equally divided down to the peritoneum. Bleeding is to be completely arrested, and the wound cleared before the peritoneum is cut and its cavity opened. This opening should be restricted to an inch and a half in extent if possible. Antiseptic measures should be scrupulously observed at this period.

The stomach may present at the wound, or may have to be searched for; its omentum may be taken as a guide from below, or the liver from above. The stomach is to be caught and held firmly but gently by the finger and thumb, or a pair of ring forceps, whilst a couple of loops of ligature silk are passed through the two outer layers of the walls of the organ, a space being left between the right and left loops. These give a very useful hold of the stomach during the rest of the operation and subsequently. Next the stomach is to be sutured to the opening. There are two ways of doing this; one way is by a carefully inserted single row of sutures, radiating from a circle of about an inch in diameter. By the other way the sutures are arranged in two rows, an outer being inserted before an inner one.

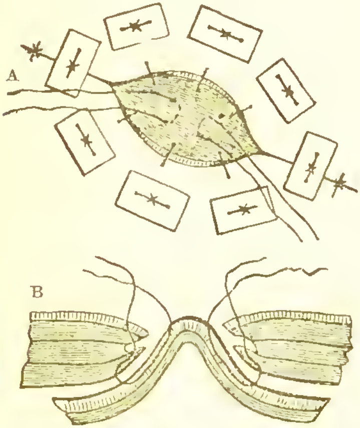

Fig. 14.—A, The relative positions of the two rows of sutures; B, the mode of passing the inner row of sutures, so that the peritoneal surfaces shall be brought into contact.

The first way is the more quickly and easily performed. From five to eight sutures will be required; they may be passed first through the stomach walls, including its two outer coats for about half an inch, and then passed through the parietal peritoneum, including half an inch of it and of the skin, but less of the muscles. The second way has the merit of more thoroughly securing the stomach to the abdominal wall, both mechanically and by primary union of the serous surfaces. The outer row of sutures is to be inserted about one and a half inches from the point at which the stomach is to be subsequently punctured, and this row is to be arranged circularly, and, therefore, at right angles to the second or radiating set of sutures. Each loop should traverse about five-eighths of an inch of the stomach wall without penetrating the mucosa; they should also be passed through the entire thickness of the abdominal wall, about three-quarters of an inch from the cut edges. These should be about half an inch apart in the stomach wall. It is better not to tie them until all have been passed, and they should be tied over bougies or leaden buttons. Carbolised silk of medium thickness is the best material, and a strong curved needle in needle-holder is the best instrument. Sutures may be needed to close the wound at its extremities. The wound is to be cleaned, and the exposed portion of stomach is to be drawn well into view, by means of the loop or loops of silk, and these fixed by plaister or fine sutures to the skin. Dry absorbent antiseptic material, such as iodoformed or carbolised gauze, is recommended as a first dressing. The same gauze soaked with carbolised oil forms a convenient application. A wide compress of salicylic wool and a few turns of gauze bandage serve to retain the dressings in place. These applications must be changed if they become in any degree soiled from the wound, but may be left for three or four days if they keep pure and in position.

By the end of the fourth, or beginning of the sixth day if the single row of sutures has been employed, the adhesive aseptic inflammation may be expected to have securely united the sutured serous surfaces, and the second stage of the operation may be undertaken.

The stomach is to be gently drawn forward by aid of the silk loops, and a puncture made in its walls, to the extent of about one-sixth of an inch. The yielding nature of its coats will allow of the introduction of a piece of rubber tubing of the calibre of a No. 10 catheter. This tube should be corked, have a collar attached to it, and be secured against slipping. Next the loops of silk may be dispensed with, and during the ensuing three or four days the sutures may be taken out. If two rows have been inserted the outer row should be removed first.

Immediately after the first stage of the operation, and during the following three to six days, the patient is to be fed by the rectum, with properly prepared nutrient and stimulant enemata, and the stomach preserved at rest as far as is possible. When after the second stage the feeding tube has been successfully secured in its place, thickened fluid nutriment may be regularly introduced into the stomach by the help of a funnel or syringe. The fluids should be duly pancreatised or peptonised. Later, when the fistula has been established, the tube may be withdrawn after the feeding. A light dry compress should be applied in the intervals. Gradually the patient learns to feed himself, and acquires power of digesting solid food most gratifying to himself.

By this method of operating the risks of peritonitis from the extravasation of septic products from the wound or the opened stomach are most efficiently prevented, but it is not always possible to prolong the operation into two stages, or even to subject the patient to a single long procedure. If disease and emaciation have reached an advanced stage, the attempt to administer nourishment by the stomach cannot be delayed. The organ must be opened at once, though this act enormously increases the risks of a speedily fatal result. In this case experience has shown that a very limited puncture of the stomach, after a careful antiseptic, but quick operation, leaves the patient exposed to the least amount of risk.

There is little doubt but that the gravity of the operation of gastrostomy depends rather upon the condition of the patient than upon the circumstances of the procedure. A greater evil is effected by delay than by the surgeon's knife, and as soon therefore as the need of the artificial opening is recognised, the operation should be undertaken without loss of time.

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IRURGICAL SOCIETY

VI. INJURIES AND DISEASES OF THE ABDOMEN.

Henry Morris.

Contusions.

Contusions of the abdominal parietes are serious in proportion to the area and depth of the tissues involved. If the peritoneum be implicated the danger is considerably increased. Subcutaneous rupture of a large muscle or blood-vessel is a serious complication.

Contusions may be classified as: 1. Simple contusion or bruise. 2. Contusion with extravasation of blood. 3. Contusion with ruptured muscle. 4. Contusion with disorganisation of tissue. 5. Contusion followed by inflammation and suppuration.

Simple contusion or bruise.—*Symptoms.* (*a*) Ecchymosis, (*b*) tenderness, (*c*) pain, (*d*) swelling, and (*e*) shock.

Ecchymosis, the discoloration dependent on rupture of the capillaries of the skin and subcutaneous cellular tissue, must not be mistaken for extravasation of blood among deeper structures; for hæmorrhage among the muscles or in the subperitoneal tissue may occur with no external evidence of its existence. Ecchymosis may be distributed in spots or spread uniformly over a considerable area, especially when it affects the umbilical or epigastric regions.

Tenderness; when experienced immediately after the reception of the injury, does not indicate internal mischief; but its occurrence after the expiration of many hours points to the development of peritonitis.

Swelling depends upon the texture of the contused region and the amount of blood and serum effused. It is sometimes considerable in the loose tissue of the loin.

Pain is caused by injury to nerves, or by the pressure of effused fluid upon them. It is aggravated by movement, and especially by coughing and vomiting.

Shock is an uncertain symptom, being sometimes absent, and occasionally so severe as to cause instant death. Vomiting occasionally accompanies abdominal contusions, and is very apt to occur if the injury is sustained soon after a meal. Although no symptom may supervene immediately upon the occurrence of an abdominal contusion, peritonitis may nevertheless set in after the lapse of some seven or eight days.

Diagnosis and *prognosis.*—The diagnosis is based upon a close observance of the development of the symptoms, the character of the vomit, of the fæces, and of the urine. Extreme sudden collapse with steadily increasing pallor suggests internal hæmorrhage or the rupture of a viscus.

Treatment.—Every abdominal injury should be treated as if it were serious. Rest in bed and a posture which secures muscular relaxation must be maintained. Pain is relieved by warm fomentations, and collapse must be treated by warmth to the spine and extremities. A blood tumour, if present, must be aspirated, or reduced by cold and pressure with strips of adhesive plaister. Peritonitis must be met by opium, warm fomentations, and leeches.

Extravasation of blood complicating contusions may be due to rupture of the superficial vessels, in which case the skin of the iliac, umbilical, and hypogastric regions may be of a black colour, and the blood may descend to the scrotum and thighs. It may be due to laceration of the deep vessels when it occurs between the muscles and peritoneum ; or within the sheath of the rectus, causing, in the latter case, a circumscribed swelling.

The *treatment* of such injuries consists in absolute rest, evaporating lotions, and, in exceptional cases, where the effusion is very copious, the use of the aspirator.

Rupture of one of the abdominal muscles complicating contusion is more prone to take place in the rectus than in the broad parietal muscles, and may be caused by direct or indirect violence. The retraction of the ruptured muscular fibres gives rise to a gap which is soon filled with blood, the absorption of which leaves the recess again apparent; if not repaired by adhesive inflammation, this gap constitutes a weak spot in the abdominal wall, through which a ventral hernia may subsequently protrude.

Treatment.—This consists in so relaxing the muscles as to approximate the separated edges, and retain them in contact if possible, during repair. Should a ventral hernia occur, a slightly concave truss, well padded, should be retained by a suitable belt.

Pulpefaction of the injured parts accompanying contusion may cause such disintegration of the affected structures as to induce gangrene. If the injury be superficial, involving only the skin, cicatrisation soon follows; but if the disorganised tissues are deeply seated, inflammation and suppuration occur; sloughs are subsequently discharged through the apertures made for the evacuation of pus, and the weakened points in the abdominal parietes frequently form the seat of hernial protrusions.

Treatment.—This must favour the natural separation of sloughs. The parts must be antiseptically treated and warm fomentation applied; the strength must be supported; opium is demanded for the relief of pain, and quinine or ammonia and bark for the improvement of the appetite.

Suppuration and abscess.—*Causes.* Suppuration may result from blows, pressure, strains, breaking down of coagula, or extravasation of urine. Disease of the osseous walls of the abdominal and pelvic cavities is a frequent cause of abdominal abscess. Purulent deposits may occur without any assignable cause in the subjects of scrofula and syphilis. Diffuse abscesses are generally deep seated, and occur amid the loose cellular tissue under tendinous expansions. Superficial diffuse suppuration follows erysipelas, and is conduced to by conditions involving great depression of vital power. Circumscribed parietal abscesses occurring in the fore part of the abdomen are probably either subcutaneous, within the sheath of the rectus, or between the transversalis and the peritoneum. When met with in the lateral and posterior regions they are usually intermuscular.

Symptoms.—In the acute form fever suddenly occurs, accompanied by rigors, vomiting, and severe local pain, but without general abdominal hardness or tenderness. At length redness and œdema of skin, brawny hardness, and acute tenderness indicate the seat of abscess, though no distinct fluctuation may be detected.

Diagnosis.—Inflammation and suppuration of the abdominal parietes may simulate the affections of the subjacent viscera. Thus, in the hypochondria the signs of a parietal abscess may resemble those of hydatid, abscess of liver, enlarged gall bladder, diseased spleen, or empyema. In the umbilical area strumous disease of the mesentery, malignant disease of the stomach or pancreas, or fæcal accumulation in the transverse colon, may simulate abscess, just as disease of the kidney, colon, or spine may do so in the loin, or pelvic cellulitis, ovarian or uterine disease in the hypogastrium. "Phantom" tumours due to tonic contractions of portions of muscles, and most frequently found in the course of the rectus, may be distinguished by being fairly resonant, not painful on pressure, and by their disappearance under continued manipulation while the patient's attention is diverted.

Treatment.—Rest, warm fomentations, leeches, and cooling salines to reduce inflammation, and anodynes to relieve pain. As soon as the presence of matter is suspected, an exploratory puncture should be made, and the abscess freely evacuated without delay. Deep-seated abscesses, if left to themselves, may induce visceral adhesions and fæcal fistula; blood-vessels may be ulcerated into, or the kidney become disorganised by pressure. After evacuation of the pus, antiseptic fomentations and tonics are requisite.

Contusion with injury to nerves.—Blows on the epigastric and umbilical regions, which have caused sudden death without leaving a trace of injury to viscera or the parietes, have been supposed to prove fatal by injuring the solar plexus. Though this mode of death has been called in question by some authorities, a few recorded cases leave no reasonable doubt of its occasional occurrence.

Contusion with rupture of blood-vessels.—The aorta, vena cava, and other important abdominal vessels are apt to be ruptured by a sharp blow or some crushing force. An aortic rent is generally transverse, sometimes involving all the coats, at others the internal and middle tunics only.

Symptoms.—If the rupture be complete in a large vessel, hæmorrhage with syncope will be extreme. If the rupture affects some of the coats only, or merely causes contusion without actual laceration, hæmorrhage will not occur; but the reduced calibre of the artery, and consequently the diminished blood supply, will tend to gangrene, or an aneurism may result from the strain.

Treatment.—Absolute rest in the recumbent posture in a cool room; ice to the abdomen; and opium to relieve pain and quiet the circulation. Evidence of continuous or recurrent hæmorrhage demands abdominal section with the view of exposing and securing, if possible, the bleeding vessel.

RUPTURE OF THE VISCERA.

Rupture of the stomach.—Owing to its comparatively protected position the stomach is more rarely ruptured than the intestine. The situation and linear direction of the rupture vary considerably. The laceration, as in the case of the intestine, usually involves all the coats.

Rupture of the small and large intestines.—Complete rupture of the bowel may be caused by a smart, not necessarily heavy, blow, and need not prevent a person from walking about for a short time. No symptoms may follow laceration of the intestine for several hours, and complete section of the bowel has occurred without escape of its contents. Out of sixty-three recorded instances of ruptured gut there were only four of torn duodenum, this part of the intestine being in great measure protected from injury by the overlapping liver and transverse meso-colon. The cæcum is more liable to rupture than the ascending or descending colon. If a viscus be distended at the time of injury, the risk of complete rupture is greatly increased.

Symptoms of gastro-intestinal rupture.—Faintness and collapse; intense burning pain spread over the abdomen; hippocratic countenance; pulse feeble and intermittent; rigors, thirst, vomiting of the stomach's contents, and then of blood, either alone or mixed with bile; tympanitis, or, on the other hand, flatness and rigidity of the abdominal wall, and, possibly, retention of urine. These symptoms may be followed by those of traumatic peritonitis.

Diagnosis.—Prolonged collapse, sudden tympanites, acute pain and tenderness, blood in the ejected matters, but without evidence of marked internal hæmorrhage, following a blow on the abdomen which has not caused external injury, are characteristic symptoms. The symptoms attendant upon simple contusion are similar, though much less severe, and more amenable to relief than those of rupture. It is important to distinguish primary rupture from ulcerative perforation, such as that which may occur in the cæcum from the obstructive action of a stricture in the bowel below.

Prognosis.—Death is almost certain to follow rupture, and may occur quickly from collapse, peritonitis, or intestinal obstruction; and at a later date, even some weeks after the closure of the rent, from pyæmia.

Treatment.—For the first forty-eight hours, not a particle of food or drop of fluid should be taken. After this period small quantities at a time of milk, beef-tea, etc., may be given. Thirst is relieved by sucking small pieces of ice, or painting the fauces with acidulated water. Stimulants and purgatives are hurtful. The recumbent posture, with the knees raised and supported by a pillow, must be maintained; subcutaneous injections of morphia, or minute doses of opium, and hot poppy-head fomentations are generally needed to relieve pain. The possibility of retention of urine must be remembered and catheterism resorted to if necessary.

Rupture of the solid viscera.—The causes of rupture of the solid viscera are similar to those of rupture of the stomach and intestines. The peritoneal coat is generally torn as well as the substance of the organ. The liver, spleen, or kidney may be lacerated by broken ribs.

These ruptures generally prove rapidly fatal from hæmorrhage, and if the patient survives the first few days after the injury, he will probably succumb to recurrent hæmorrhage or peritonitis.

Rupture of the liver.—The position and extent of a laceration of the liver are variable. Either surface or lobe may suffer.

Symptoms.—Extreme pallor and coldness of surface, shallow breathing, feeble pulse, abdominal distension, pain, and vomiting. If death does not occur from hæmorrhage, jaundice and diabetes may follow the injury, as may also peritonitis and abscess.

Rupture of the spleen.—This injury, which is not so common as rupture of the liver, is often associated with fractured ribs. It has occurred spontaneously in the course of typhus or typhoid fever, and in the hot stage of ague. Hæmorrhage is the chief cause of death after rupture of the spleen.

Symptoms.—These are very similar to those which characterise rupture of the liver.

Rupture of the kidney.—This is not such a very uncommon accident; hæmaturia is a frequent though not an invariable symptom of it. The prognosis is not so unfavourable as in the case of rupture of the other viscera. (*See* Art. XII., vol. iii)

Treatment of rupture of the solid viscera.—Absolute rest, avoidance of solid food; subcutaneous injections of anodynes. Gallic acid, ergot, and iron to check hæmorrhage.

Strapping the affected side by securing gentle pressure and limitation of movement controls hæmorrhage. The bowels must not be disturbed for some days. Fluids only, and those in small quantities, should be given for two or three weeks.

If peritonitis occurs it must be treated on the usual plan. Abscess may require opening and draining. If blood accumulates in the bladder and gives rise to much distress, median urethrotomy or lateral cystotomy should be performed, so that clots may be discharged through the wound in the perinæum. If in renal injuries the kidney becomes the seat of exhausting suppuration, nephrectomy is indicated.

Rupture of the gall bladder and biliary ducts.—Rupture of the gall bladder, or the ducts of the biliary system, may be caused by external violence, dilatation from sclerosis of their coats, compression by new growths, impaction of calculi, or other pathological processes, leading to ulceration of their walls.

The occasional extravasation of bile into the abdominal cavity consequent upon the rupture of the gall bladder by impacted calculi has resulted in fatal peritonitis.

It is the considerable and rapid discharge of bile into the serous cavity which causes death in such cases; if, on the other hand, the effusion is so gradual as to allow of the formation of a cyst-like chamber shut off from the general peritoneal cavity by adhesive inflammation, large quantities of bile may accumulate outside the passages, and form a large tumour in the right hypochondrium. Cases of this kind have been ultimately cured by repeated tappings; the fæces, which were at first white, gradually resumed their normal colour as the proper channel for biliary discharge became re-established.

The gall bladder may be torn away from all its connections without causing immediate death, or escape of its contents; within a few days, however, the fatal issue is ushered in by hæmorrhage or acute peritonitis.

The commonest seat of rupture is some part of the cystic duct.

Symptoms.—If no extravasation occur, the collapse, abdominal pain, vomiting, and dyspnœa which attend the injury soon pass off. Effusion into the peritoneal cavity induces acute peritonitis.

Where the gall bladder itself gives way, instant death is the usual result.

The jaundice which follows rupture of one of the ducts is probably as much due to shock as to obstruction at the seat of injury.

Treatment.—Great quietude should be enjoined, to prevent, if possible, biliary extravasation, and to give time for the surrounding of the wounded part by organisable lymph. Absolute rest in bed is imperative; warm fomentations and a few leeches applied over the seat of the injury relieve pain; vomiting, which is apt to prove dangerous, should be restrained by the use of ice and sedatives. Small quantities of liquid food only should be given, and no purgatives should, on any account, be employed, enemata, if anything be necessary, being substituted. If a tumour forms, the bile should be evacuated through a canula. Laparotomy, followed by suturing the rent or attaching it to the abdominal parietes, or by removal of the gall bladder, ought, in certain cases, to be adopted.

Rupture of the thoracic duct.—Very little is known of this accident as a complication of other abdominal ruptures. It may be caused by dilatation of the duct due to the pressure of some growth, or by cheesy concretions in the duct itself.

Rupture of the peritoneum.—The parietal or visceral layer of peritoneum may be ruptured without injury to the muscles of the parietes or to the other coats of the viscera. Such an accident is rare as the result of a blow or other form of external violence, but not so very uncommon in the case of the peritoneum covering the uterus, or as a result of over-distension of the stomach or intestine. The two chief dangers of this lesion are hæmorrhage and peritonitis.

TRAUMATIC PERITONITIS.

Causes.—Injuries to the abdominal parietes, ruptures of hydatid, ovarian, and other cysts, the bursting of an abscess, perforation from disease of the hollow viscera, are the most common causes of peritonitis. Fatal peritonitis has also been induced by the penetration of the gut by intestinal worms.

The term traumatic peritonitis is generally applied only to inflammation started by some blow or other form of external violence. Although no inflammation may follow an operation involving an extensive wound of the peritoneum, provided that antiseptic precautions are adopted, still peritonitis may be the outcome of very trivial wounds if the system be in an unhealthy condition, or if foreign bodies be introduced from without or escape from the viscera within.

Varieties.—Although apt to spread over the whole of the membrane, traumatic peritonitis may be limited to the immediate site of injury. It is generally acute, but will probably become asthenic or puriform in an unhealthy subject.

Symptoms.—These generally set in from six to thirty-six hours after the injury, and then develop very rapidly. Although in some cases the symptoms may occur almost immediately upon the reception of the injury, at other times they may be delayed for some days.

Acute pain of a burning, cutting, or stabbing nature, perhaps ushered in by a rigor, and, though at first localised, soon extending in area, is the earliest and most striking symptom. In order to restrain the abdominal respiratory movements and relax the muscles as much as possible, the sufferer lies with his thighs and knees flexed, and sometimes uses his upper limbs to keep the weight of the bed clothes from pressing, however lightly, on his belly. Although pain is usually very pronounced, it may be absent in exceptional cases.

Vomiting is an early and distressing symptom, and occurs whether anything is taken by the mouth or not. At first the contents of the stomach and upper part of the intestine are ejected, the vomited matters then become greenish and watery, and subsequently perhaps fæculent. Eructations and hiccough, with constipation and gaseous distension of the bowels, are generally present. With the tympanites are sometimes associated feeble peristaltic movements; and gurgling sounds or borborygmi may be heard. Before the distension occurs the abdominal muscles are rigidly retracted. Micturition of the high-coloured urine loaded with urates is frequent and scalding; retention follows from palsy of the vesical muscles. The quick, shallow respiration is entirely thoracic. Vaso-motor irritation is excessive.

The small wiry pulse may range from 120° to 160°; and the arteries are contracted. The heart, nevertheless, beats slowly and feebly. Intestinal movements are visible through the parietes, the muscles of which, though they contract on palpation even in the early stage, soon render the abdominal wall as tight as a drum, and the normal hepatic and splenic dulness becomes quite lost.

The temperature, rising rapidly, continues high for a day or two. It has, however, no regular course, and in asthenic cases is generally subnormal.

The tongue is furred at the sides, and red or brown and dry in the centre. Thirst is intense. The hands and feet are burning; the features are pinched and expressive of agony; there is extreme prostration, but rarely any delirium or impairment of the mental faculties. In exceptional cases ascites, with fluctuation, is present, and delirium may be a pronounced and early feature. High fever, bloody vomit and stools, diarrhœa, urgent dyspnœa, and albuminuria, are occasionally witnessed.

Diagnosis.—Cutaneous hyperæsthesia, localised inflammation, or even rheumatic affections of the abdominal parietes, when accompanied by distension, obstinate vomiting, and constipation, might, without proper care, be mistaken for peritonitis, just as may colic, if attended by vomiting, rapid pulse, and tendency to collapse. But the history of the case, posture, and pinched expression of countenance, exquisite sensitiveness of the abdominal wall to pressure observation of temperature will generally indicate with certainty the presence of peritonitis.

Prognosis.—The more localised the inflammation, the more hopeful the issue; the more rapid the symptoms, the graver the case. When the peritonitis is the result of direct injury limited to the peritoneum or parietes, the prognosis is comparatively favourable; but when due to lesion of the viscera or the influence of septic poison, death is almost certain. The fatal termination usually occurs within a week or ten days; sometimes much earlier. Death occasionally takes place during the height of the fever, but it is generally induced by asthenia, fatal collapse supervening. As life ebbs away the pain subsides, the temperature falls below normal; the previously hot, dry limbs become cold and clammy; the flickering pulse is too rapid for counting, the voice almost inaudible; and sometimes immediately before or after death a quantity of dark-coloured fluid flows freely from the mouth and nose.

Occasionally the acute symptoms of peritonitis subside, leaving the patient prostrate with some localised collection of fluid. This may burst and find its way into some hollow organ, and recovery eventually ensue, or death may be caused by pyæmia, septicæmia, or exhaustion. Although a case of limited traumatic peritonitis may, if the patient be of vigorous constitution and the treatment judicious, terminate favourably, death may occur at any period after recovery from the effects of adhesions or bands, the products of inflammation. Complete intestinal obstruction is occasionally the result of these adhesions.

Treatment.—Of course, absolute rest in such a posture as to diminish abdominal tension is of paramount importance.

Local bleeding, which is only of use in the early stage, and vastly preferable to venesection, may be secured by the application of twenty or thirty leeches. Depletion, though valuable in acute traumatic peritonitis, is contra-indicated in those asthenic forms of inflammation which follow hernia, ovariotomy, or other operations. Hot fomentations are also of great service in relieving pain, especially when supplemented by opium or belladonna.

Ice-cold compresses over the abdomen may prove beneficial in the early stage, but must on no account be tried in the later stages. Subsequently, blisters, iodine, or mercury may be useful in tending to promote absorption. Grain doses of opium should be given every few hours to relieve pain and quiet the stomach and intestines. Morphia may be subcutaneously injected, but opium must be administered with great caution in the cases of young children or the subjects of renal disease. In young subjects of sthenic inflammation calomel may with advantage be combined with the opium in grain doses. Vomiting is best checked by hydrocyanic acid and ice. Constipation must be tolerated for a few days, and then relieved by enemata. No food, save a little iced milk, is needed for the first forty-eight hours; then thick beef-tea may be given in teaspoonfuls at frequent intervals. If the stomach is very irritable, two ounces of beef-tea may be injected every six hours. Great depression indicates the necessity for wine or brandy. As convalescence advances the diet may become more liberal.

PERITONEAL AND RETRO-PERITONEAL EXTRAVASATION.

Extravasation into the subperitoneal or retro-peritoneal tissues may consist of air, blood, urine, fæces, or pus.

Air.—The source of the air is not always traceable, but its distribution is often very extensive. Wounds of the loins, groins, and perinæum, whether complicated by wounds of the bowel or not, and fractures of the lower ribs with lung injury, may be the cause of extravasation of air.

Decomposition may in some cases explain the presence of gas. Retro-peritoneal abscess opening into the bowel may of course give rise to it.

Blood.—Effusion of blood may result from injury to an artery or vein, or to capillaries. Extravasation with the formation of a hæmatoma which may ultimately break down and suppurate, is very apt to follow violence inflicted upon the loin or pelvis. Lumbar injuries may cause blood effusion beneath the capsule of the kidney.

Some of the most frequent hæmorrhages into the pelvis are those known as "subperitoneal or encysted pelvic hæmatoceles, which by a vaginal or rectal examination will be revealed as a soft, smooth, and elastic or fluctuating mass, fixing or displacing the uterus. As the extravasation increases, there are fulness, dulness, and tenderness with a sense of resistance in the hypogastrium and iliac fossa, or in the latter region alone. There is a sense of bearing down with tenesmus of the rectum and frequent desire to micturate; only a little mucus, however, is expelled from the rectum, and there is retention of urine. Occasionally the posterior vaginal wall is pressed as low as the perinæum by the enormous extravasation beneath the peritoneum in Douglas's pouch. The effused blood becomes gradually more solid and the tumour irregular, and it is either slowly absorbed, or after consolidation it may disintegrate and soften, giving rise to symptoms of retro-peritoneal suppuration.

The *sources* of blood vary in the different regions; sometimes it is derived from one of the venous plexuses, namely, uterine, ovarian, hæmorrhoidal, vesical, or prostatic, or from one of the corresponding arterial branches. Rupture of muscular fasciculi, as in the case of the psoas, iliacus, or quadratus lumborum, sometimes causes free hæmorrhage. The bursting of an aneurism of the abdominal aorta is occasionally the cause of extensive retro-peritoneal hæmorrhage. There is rarely any pulsation in such swellings, and the diagnosis is next to impossible. Erosion of the vertebræ from aneurismal pressure might lead to a suspicion of lumbar caries with abscess, but to open such a tumour on mere supposition would be a very rash proceeding, and might prove fatal.

The mode of death in cases of peritoneal extravasation dependent on aneurismal lesion may be from peritonitis or syncope, but more generally from anæmia.

Urine.—Extravasation of urine into the retro-peritoneal tissue of the loin may be caused by ulceration, wound, or rupture of the kidney or its pelvis; or by ulceration of the ureter from pressure of a morbid growth. Into the subperitoneal tissue of the pelvis, urine escapes from the bladder after rupture; or through an ulcerous or fistulous syphilitic opening arising either within or outside the bladder walls. The effusion may extend widely, displacing and pushing forwards the overlying viscera. The inflammation thus excited may run on to suppuration with pointing in the loin or groin, or the cellulitis may become chronic, and, spreading slowly towards the iliac fossa, cause contraction of the ilio-psoas muscle. In some instances the urine which has been effused becomes encapsuled within a thick-walled cyst with which the kidney communicates at its point of rupture. The urine contained in such a cavity is deficient in urea, and therefore less irritating than normal urine; occasionally, however, the urea is in excess. Urine may escape from a wounded kidney so slowly that weeks or even months may elapse before the amount of local swelling is sufficient to suggest extravasation, or in the absence of hæmaturia, even to indicate renal lesion.

After rupture of the bladder, urine diffuses itself widely in the pelvis, or spreads over the front of the abdomen, or descending along the course of the obturator vessels, invades the thigh. Acute peritonitis generally proves fatal in the course of a few days, or pus may form and be discharged into the peritoneal cavity, bladder, or rectum.

Fæces.—In consequence of injury or ulceration, fæces may escape into the retro-peritoneal tissues from the ascending and descending colon, the cæcum, the sigmoid flexure, the rectum, and the second and third parts of the duodenum. Fæces may escape into the cellular tissues from any other portion of the bowel, if adhesions have previously fixed it to the parietal peritoneum. Cancerous, tuberculous, dysenteric, and other forms of ulcer; obstruction followed by ulceration, and abscess opening into the bowel, are common causes of fæcal extravasation; penetrating wounds are also occasional causes.

When a *fæcal abscess* has been recognised and properly treated by laying it open and irrigating it, or when it has spontaneously ruptured into the bowel or bladder, the prognosis must depend largely upon the cause of the extravasation. If due to simple ulceration or violence, and beginning outside the bowel, there is hope of recovery, even without a permanent fæcal fistula. If, on the other hand, it originate in tubercle or cancer; from adhesions resulting in obstruction; from caries of bone or some inveterate disease of the uterine appendages, death from blood poisoning, exhaustion, or acute general peritonitis will be the inevitable result.

Wounds of the Abdomen.

Abdominal wounds are termed *penetrating* or *non-penetrating*, according as they involve or not the peritoneal cavity.

The *non-penetrating* wounds may, in the lumbar and hypogastric regions, be complicated by protruding or wounded viscera, without implication of the peritoneum. Such wounds, which are not very dangerous, are purposely made in operations on the colon and kidney.

Penetrating wounds, which, as a class, are far more serious than non-penetrating, may also be complicated with protrusion, and injury of the viscera. It is rather surrounding untoward circumstances than the mere fact of their perforating the peritoneum that contribute to render these wounds dangerous. Incised wounds of the abdomen are the simplest and most favourable; lacerated and contused wounds are the most tedious in recovery, and prone to be followed by suppuration and sloughing; and gun-shot wounds the most fatal.

Non-penetrating wounds of the abdomen.—These wounds may be either incised, punctured, lacerated, or contused.

They differ in no essential particular from like wounds in other parts of the body. The degree of gaping the wound presents will depend upon its situation and direction, and the extent to which subjacent muscles are divided. The gaping will be greatest when the cut is at right angles to the axis of the muscle fibres. Severe bleeding may occur from branches of the internal mammary, epigastric, and circumflex iliac arteries.

Inflammation of the deeper structures running on into suppuration, attended by typhoid symptoms, and not unfrequently proving fatal, almost certainly follows wounds inflicted with rusty, dirty, or blunt instruments. Among the first indications of inflammation are swelling of the wound, redness round its edges, cessation of previous discharge, and general abdominal tension. The constitutional symptoms are those of inflammatory fever, and the occurrence of rigors and vomiting are indicative of suppuration.

The treatment of these wounds is the same as that for like injuries elsewhere.

To one rule especial attention must be drawn. Never probe a punctured wound of the abdomen.

Penetrating wounds of the abdomen.—These may be divided into (1) simple wounds; (2) wounds with protrusion of, but without injury to, the abdominal contents; (3) wounds with protrusion and injury; (4) wounds without protrusion of, but with injury to, the viscera.

The attitude and mental condition of the patient, and the external appearance of the wound, are often very fallacious standards whereby to estimate the extent and danger of an abdominal injury.

The wound, though on the surface simple, may be complicated by serious internal mischief; whereas a large lacerated surface lesion may not be attended with any damage to the deeper structures.

Simple penetrating wounds.—If a wound is narrow, or oblique, it is often very difficult to say whether it penetrates or not. In endeavouring to ascertain the fact of penetration, the relative size of the wound, and shape and size of the instrument, must be compared. The habit of body of the individual, whether corpulent or thin; as well as the site of the wound, whether in the epigastrium or flank, are points to be noticed. A lobule of protruding fat must not be mistaken for omentum. The inflammation excited by the wound results from some visceral injury and peritoneal extravasation, rather than from the admission of air, which used to be considered one great source of danger in penetrating wounds. The limited amount of inflammation following the majority of simple peritoneal wounds usually terminates by adhesion, which rapidly heals the injury. But occasionally the inflammatory action, instead of restricting itself to the lips of the wound, extends over a wide area of the peritoneum, affecting the vital organs which it covers. It is the tendency to adhesion of its layers, possessed by the abdominal in common with other serous membranes when inflamed, that constitutes the means of cure. Constitutional disposition and visceral degeneration of course influence the character of the local inflammation. The symptoms, diagnosis, and treatment of traumatic peritonitis have been already fully described elsewhere.

Treatment.—Cases occur in which the desperate extent of laceration and injury negatives the chances of recovery in patients suffering from penetrating wounds. However hopeless the case may seem, it should not be given up as lost. The wound having been cleansed, bleeding checked, sutures inserted, and some light antiseptic dressing applied, the patient's posture should be such as to relax the abdominal muscles. The sutures, which should include the peritoneum, with the whole thickness of the parietes, should be passed from within outwards. Sthenic inflammation in a plethoric subject should be treated by depletion. Low diet of a strictly fluid consistence should be given. Absolute rest is, of course, necessary; opium may be given to relieve pain, and enemata administered if requisite.

Penetrating wounds with protrusion of uninjured viscera.—The viscera which have the greatest tendency to protrude are the small intestine and the omentum. The duodenum is rarely protruded unless dragged with the stomach, and the cæcum and sigmoid flexure are less likely to escape than the transverse colon. Protrusion of the bladder has occasionally occurred. Cases of protrusion of the solid viscera are comparatively rare.

Treatment.—When the wound is recent and the protruded organ uninjured, it should be returned into the abdominal cavity without delay. The protruded parts should, if necessary, be cleansed with a gentle stream of warm milk and water. They should be returned methodically to their normal relative positions, and care must be taken not to force them between the different planes of the abdominal wall, or into the rectus sheath, or between the peritoneum and pelvic cellular tissue, instead of into the peritoneal cavity. The peritoneum in old people and in certain regions is very easily detached, so that large portions of protruded viscera may be carelessly forced into such false sacs instead of into the abdomen.

If the narrowness of the aperture through which the structures protrude resists the efforts to return them, relaxation of the parietes should be secured, and retractors inserted to separate the margins of the opening. If such measures prove abortive, the aperture should be enlarged very carefully with a probe-pointed bistoury, the peritoneum being, if possible, spared.

If *omentum* which has protruded be deeply congested, partially strangulated, or adherent to the wound, the proper plan is to apply ligatures to it on a level with the edges of the wound, cut them short, and cut away the part of the omentum beyond the ligatures, leaving the stump at the wound if it be already adherent to its edges, but returning it just within the abdomen if it be not adherent. Care should be taken that no knuckle of bowel is hidden behind or within the omentum; the protruded loop ought to be carefully unravelled before being tied.

Protruded *intestine* may be irreducible, partially strangulated, or completely gangrenous. Where the protruded bowel is so distended with air as to render its return impossible until the parietal wound is enlarged, great care must be exercised in increasing the size of the aperture lest fresh portions of gut protrude. Puncturing the distended intestine has been recommended; but such a procedure should not be adopted unless the bowel is in a perfectly healthy state, and even then moderate enlargement of the parietal aperture is preferable. If adhesions have formed between the bowel and the surrounding parts at or outside the opening, they must be gently broken down or divided.

If the bowel has become simply congested or actively inflamed, or in a state of strangulation, it should be returned as soon and as gently as possible through an enlarged opening. But if the intestine has lost its glistening appearance and is of a brownish-black colour, with its friable and swollen coats studded with ashen-grey spots, its condition is gangrenous, and if returned in such a state death would be the inevitable result. Should it be unadvisable to wait for the gut to form a false anus by fixing itself to the edges of the parietal wound by adhesive inflammation, enterectomy should be performed. This operation is especially indicated where the false anus would be so high up in the bowel that the chyme escaping through it would cause death from inanition. The nearer the strangulation is to the stomach, the more severe will be the symptoms.

Protrusion of the solid organs is a rare occurrence. The treatment must depend upon whether the organ is wounded or not. If not, and the case be seen at once, the protruded portion should be returned, the parietal wound having been previously enlarged if necessary; if the organ be seriously wounded, or damaged from long exposure, it should not be returned. If it be the liver, the protruded part should be cut away, after a ligature has been applied. In the case of the kidney, and perhaps also of the spleen, the whole organ had perhaps better be excised.

Protrusion of the uninjured bladder very rarely occurs. When protruded, the soft compressible swelling readily yields to reduction, which is accompanied by an urgent desire to make water. After reduction a soft catheter should be for a time retained.

The treatment of all wounds after the reduction of protruded viscera is the same as that of simple penetrating wounds.

Penetrating wounds with protrusion of injured organs.—In the case of *wounded intestine* there are certain special characters depending on the action of the bowel. If the gut is cut across, the orifice to some extent opens and closes alternately, and the contents are alternately ejected and arrested, in accordance with the muscular movements of the bowel. In punctured wounds the mucous coat is everted, and constantly fills the opening, thus preventing effusion. Longitudinal wounds of the bowel are naturally more amenable to spontaneous repair than transverse ones.

Treatment.—In the case of a small punctured wound a ligature may be tied round it like a string round the neck of a sack, and the ends cut short.

If the wound be larger, a continuous suture of fine silk should be used. The gut is then to be returned, and the external wound treated as if the injury had been a simple penetrating wound. An incised wound must be stitched up with the Glover's or spiral suture, Lembert's or Gely's. In complete division of the bowel involving perhaps even the mesentery, the ends may be either stitched together in part of their circumference, and to the edges of the parietal wound in the remaining part after the return of the bulk of the protruded bowel; or the divided edges may be accurately united all round with their peritoneal surfaces in contact, and then returned. The former plan, resulting in a false anus, is applicable to cases where, either from enfeebled constitution or contused state of the edges of the wound, adhesive inflammation is not likely to occur.

In wound of a *protruded stomach* the contents are almost invariably expelled by vomiting instead of escaping into the abdominal cavity. If the wound be small, the prolapsed portion may be simply left in the external wound; but if large the wound of the stomach should be closed by suture, and the prolapsed portion left in contact with the parietal wound, but even then healing may be retarded by a fistulous opening.

If the edges of the stomach wound be bruised or lacerated, it will be advisable to retain them by a suture to the edge of the parietal wound. In no case in which a wounded viscus has been treated by sutures and returned should an attempt be made by means of a suture to retain it near the wound in the abdominal wall, but the external wound should be closed.

Terminations.—Protruded stomach or intestine which has been wounded may heal after being returned into the abdominal cavity, the cure being effected either without an abnormal opening, or being followed by the formation of a false anus or fæcal fistula, which may or may not close. Recovery may take place after enterectomy. Death may ensue from collapse or peritonitis in consequence or independently of extravasation.

The mode of union of wounds of the intestine "commences with the agglutination of the contiguous mucous surfaces, probably by the exudation of a fluid similar to that which glues together the sides of a recent flesh wound when supported in contact. The adhesive inflammation supervenes and binds down the reverted edges of the peritoneal coat, from the whole circumference of which a layer of coagulable lymph is effused, so as to envelop the wounded bowel. The action of the longitudinal fibres being opposed to the artificial connection, the sections mutually recede as the sutures loosen by ulceration and absorption. During this period the lymph organised prevents further reaction, and the original cylinder, with the threads attached to it, are encompassed by the new tunic. The gut ulcerates at the points of the sutures, and these fall into its canal. The fissures left by the sutures are gradually healed up; but the opposed villous surfaces, so far as my observation goes, neither adhere nor become consolidated by the granulation, so that the interstice marking the division internally is probably never obliterated" (Travers). An inspection of the external surface of the intestine would not, however, discover, even at a recent period after the injury, the spot at which the division had taken place.

A ligature which includes a portion of the intestinal wall is followed by adhesive inflammation, and thus the ulcerated ligature wound is healed in the same way as a simple incised wound of the bowel. Sutures, except when the ends are retained at the external wound, separate inwards and pass off through the anus.

The solid organs, liver, spleen, kidney, and even the pancreas, are not excepted from the liability of being protruded and injured. (*See* special sections on injuries to those organs.)

Penetrating wounds with injury to, but without protrusion of, the viscera.—There are no certain means of verifying a wound in a non-protruding viscus (at the outset, at least), save by the escape of fæces, bile, urine, or the ingesta through the outer wound. Much depends on the nature of the wound as to whether the contents of the viscus will be effused or not. If the wound be large and in the longitudinal axis of the bowel, which is itself moderately full at the time, or if the opening be ulcerated, the contents will escape rapidly; whereas if the tube be empty, or nearly so, and the wound a punctured or small incised one, there will be little tendency to extravasation. Effusion does not usually occur unless the wound is extensive and the bowel at the same time pretty full, except in the case of extravasation of blood or air at the time of the injury. That the integrity of the parietes does not always prevent the escape of the intestinal contents is proved by the greater frequency of effusion in cases in which, without any injury to the abdominal walls, the bowels or stomach are ruptured, or perforated by ulcers, or by worms, or other foreign bodies.

Symptoms.—They vary from those of mere transient shock to all the signs of severe peritonitis. When effusion into the abdomen occurs, the course of the case is generally that of fatal peritonitis. When the effusion is external, there may be more or less shock and local tenderness, followed in a few days by recovery with a temporary fistula. When no effusion occurs, the patient may recover without any serious symptom; or, on the other hand, he may suffer from peritonitis, accompanied by hæmaturia, jaundice, bloody stools, or vomit, or followed by the passage of a bullet or some other foreign body by the rectum, or some fragment of clothing per urethram. Suppuration and sloughing about the external wound will be followed after some weeks by healing by granulation.

Diagnosis.—A penetrating wound with injury to an organ, unless attended by external effusion of its contents, can only be diagnosed from a simple penetrating wound if blood escape from the mouth by vomiting, from the rectum, or from the urethra, or if the missile or some foreign body, as a piece of clothing, be passed through one of the natural outlets. Hæmorrhage from a visceral wound may result in fatal syncope; but there are no means of knowing the exact source of the bleeding. If free effusion of bile, fæces, or urine has taken place, it will be evidenced by distressing vomiting, acute pain, and some of the other characteristic symptoms of traumatic peritonitis.

Prognosis.—Reparation may be looked for in visceral wounds. Effusion is not a necessary result of such injuries. Extravasated blood may conduce to internal effusion, and this effusion may be the cause of fatal peritonitis. Of course, escape of visceral contents through the external wound is not so unfavourable in its results as internal effusion.

Treatment.—If there be no evidence of effusion from any organ, the external wound should be closed and treated like a simple penetrating wound.

If there be external effusion, the wound having been dressed with some warm carbolic acid lotion, its edges should not be brought together, but the discharge should be allowed to flow freely into a pad of oakum or peat moss. If the stomach or hollow viscus is seen to be wounded, the external opening should be enlarged to allow of the visceral lesion being closed by a suture. If internal effusion has taken place, scrupulous care must be taken of the peritoneum before closing the external wound. If severe hæmorrhage into the peritoneum occurs from wounded mesentery or bowel, abdominal section for removing the blood clot, ligaturing the bleeding vessel, and suturing the visceral wound, will in some cases prove successful. Probing and dilatation of the wound, except as part of some definite operation, cannot be too strongly condemned.

The general treatment consists in complete abstinence from solid food, small quantities of nutritive fluids being given at definite intervals; sucking fragments of ice to quench thirst; the bowels should be kept as quiet as possible. The recumbent posture, with the knees propped up, should be enjoined. Opium and morphia by the mouth or in the form of subcutaneous injections or suppositories tend to relieve pain and restrain vomiting.

The condition of the stomach is a much more important guide than the state of the pulse. If the stomach be not irritable there is comparatively little to fear.

Penetrating wounds of the stomach.—*Symptoms.* When the contents of the stomach escapo through the external wound, there is the clearest possible evidence of the nature of the injury. Whatever is taken by the mouth may be discharged almost at once, and unaltered, through the wound. The chief symptoms of extravasation into the peritoneal cavity are: (1) Sudden, very acute, continuous pain darting from the navel to the circumference of the trunk, and even to the limbs; (2) hardness and rigidity of the belly, owing to spasm of the abdominal muscles; (3) a natural pulse for some hours until the symptoms of acute peritonitis come on. There are also extreme anxiety, collapse, and cold sweats. Blood may be vomited, and escape by the external wound.

Prognosis.—This depends partly upon the occurrence or not of effusion, and also upon the direction of the effusion, whether into the cavity of the abdomen or externally. Punctured and incised are the most hopeful; lacerated and gun-shot the most deadly wounds. The hæmorrhage from wounds at the curvatures is very dangerous. The results of non-fatal wounds are either adhesion of the wound in the stomach to the peritoneum, and closure of the parietal lesion; or the formation of a fistulous opening, which may close after the lapse of years or remain permanent.

Treatment.—The mode of treating a penetrating wound of the stomach, and the peritonitis which may result, has been detailed in describing penetrating wounds of the viscera generally.

Penetrating wounds of the intestine.—*Symptoms.* These are more severe, and more frequently accompanied by extravasation in lesions of the small than those of the large bowel. The severity of the general symptoms is no criterion as to the extent of the injury in all cases. When there is no escape of chyle, fæces, or fæcal gas, through the external wound the symptoms are equivocal. The most characteristic signs are griping pains, urgent thirst, nausea, and vomiting, with bloody stools, and especially tympanites.

Diagnosis.—If there is escape of the intestinal contents through the external wound, the occurrence of a penetrating lesion of the bowel is, of course, certain. The lesion may be suspected if there be faintness, vomiting, extreme anxiety, cold sweats, griping pains and tympanites following upon a penetrating wound of the belly; and the diagnosis is confirmed if, some time afterwards, blood is vomited or passed per rectum.

Prognosis and *terminations.*—The danger of the case will depend upon: (1) The occurrence or absence of extravasation; (2) the persistence of vomiting; (3) the character of the hæmorrhage; (4) the nature of the supervening peritonitis.

When the effusion escapes from a wound high up in the small bowel, death from inanition will ensue. A small wound may cause death from shock, whereas a very extensive and complicated visceral lesion may be followed by no bad results. Free effusion into the peritoneum means certain death. External effusion, if not fatal from peritonitis or marasmus, may terminate in a fæcal fistula or false anus. Diffuse peritonitis is fatal. Death may follow from loss of blood. The presence of blood coagula may cause fatal peritonitis, or the clotted blood may become absorbed or encysted.

Treatment. — The general plan of dealing with wounds of the intestine has been already described. If effusion has not taken place, and the visceral wound is small, it is better not to disturb the parietal lesion with the view of applying sutures to the bowel. If effusion has occurred some time before the patient is seen, adhesive inflammation will probably have set in or the wounded structures have passed beyond the reach of repair. If, after transfixion of the belly, the viscera are wounded in several places, it is useless to interfere. If, however, there is clear evidence of extravasation from a wound, or the intestinal wound can be seen through the external opening, the visceral wound ought to be closed by suture.

Penetrating wounds of the liver.—Punctured and incised wounds of the liver are much less frequent than subcutaneous ruptures.

Symptoms.—Hæmorrhage is one of the chief dangers. There may be also discharge of bilious matter from the wound. Pain, dull, and extending to the shoulder and larynx; or acute, and located about the ensiform cartilage according as the upper or under aspect of the viscus is wounded; vomiting, hiccough, and dyspnœa, followed by occasional rigors and tympanites, and, still later, by delirium. If the patient survive many hours, and hepatitis becomes general, jaundice appears.

Diagnosis and *prognosis.*—If the weapon have passed through the parietes, between the lower right intercostal spaces, the liver must be involved. And, if the penetration be horizontal below the ribs, displacement or enlargement of the organ may subject it to lesion. Small superficial wounds are followed by recovery, but deep wounds, accompanied by free hæmorrhage into the abdominal cavity, are rapidly fatal.

The *treatment* does not differ from that described for rupture of the liver.

Penetrating wounds of the gall bladder and ducts.—These are extremely rare injuries, and very fatal when they do occur, from the accompanying peritoneal extravasation.

Symptoms. — Great tension and pain, especially in the right hypochondrium; small frequent pulse, dyspnœa, cold extremities, and sometimes jaundice, and nausea. Gun-shot wounds of the gall bladder have been attended with injury to the liver. Obstinate constipation is not a necessary result; indeed, severe prolonged diarrhœa has occurred after such injuries.

Treatment. — Penetrating wounds of the gall bladder and ducts must be treated in the same way as corresponding injuries of other viscera. It is not so much the primary escape of bile that induces death as the continual infiltration into the peritoneum. If it happened that the cyst, or one of the ducts alone, were wounded, laparotomy, followed by ligature of the duct or stitching up the wound in the cyst, or stitching the cyst to the parietal wound, might be tried, unless the liver were also seriously wounded.

Penetrating wounds of the spleen.—*Symptoms* and *prognosis.* Swelling and tension of the belly, with indications of copious internal hæmorrhage, the effused blood gravitating towards the pelvis. If hæmorrhage is not very extensive, peritonitis or localised splenitis and abscess set in. Though hæmorrhage and peritonitis frequently cause death, recovery follows some severe splenic injuries. Gun-shot wounds of the spleen, if of a minor degree, are often repaired.

Treatment.—The patient should lie on the injured side, which should be strapped to check hæmorrhage. Iced drinks and ergot should be given, and cold applied externally. If peritonitis supervene, it must be treated on the principles already laid down. Excision of the organ is advisable when it is extensively contused, or the hæmorrhage is persistent.

Wounds of the pancreas and thoracic duct.—The pancreas, if torn away from the splenic artery, and protruding through an external wound, may be removed without serious consequences. Death after wounds of the pancreas usually results from shock and peritonitis, or else from secondary hæmorrhage. Nothing of reliable diagnostic value is known with reference to lesions of the thoracic duct.

Penetrating wounds of the kidney, the ureter, and suprarenal capsule are described elsewhere (Art. XII., vol. iii.).

Penetrating wounds of the blood-vessels.—*Symptoms.* When wounds of the large vessels prove quickly fatal, the blood descends into the pelvis, the belly swells, the patient becomes pale, pulseless, and cold, and after several convulsive movements, dies. In the case of a smaller vessel, some time elapses before the extravasation is considerable. A fluctuating tumour is then felt in the lower part of the abdomen ; the consequent pressure on the bladder exciting distressing efforts to micturate, and that on the large bowel causing constipation and tenesmus. Subsequently, the peritoneum perhaps becomes inflamed, and death takes place ; or peritonitis may be escaped, and if the hæmorrhage ceases, and the effused blood becomes absorbed, convalescence ensues.

Treatment.—In hæmorrhage from wounded vessels no reliance must be placed on compression by bandages and pads, or on astringents. The wound should be enlarged, ligatures or torsion applied to the vessel ; the blood carefully removed from the peritoneum, and the external wound closed. In wounds of the musculo-phrenic, or superior epigastric arteries, where ligation at the seat of lesion is impracticable, the internal mammary artery should be ligatured in the second or third intercostal space.

GASTRIC FISTULÆ.

Fistulæ of the stomach may either communicate with other hollow viscera, or open externally, in which latter case they may be termed gastro-cutaneous.

Causes.—Gastric fistulæ may be caused by mechanical injury, or result from disease. There are four kinds of mechanical injury which may lead to fistula :

1. Incised, punctured, or lacerated wounds of the abdomen penetrating the stomach.

2. Gun-shot wounds ; the shot directly penetrating the stomach, and causing a fistulous opening ; or the fistula being subsequently established by the sloughing of the part of the wall of the viscus in contact with the parietal wound.

3. A blow over the stomach, which, by causing parietal abscess leads to adhesion of the stomach, and subsequent fistula.

4. Ulceration from external pressure.

The diseases which may lead to fistula are cancer and simple perforating ulcer of the stomach. These may induce it :

1. By gradual extension of ulceration through the area of the abdominal parietes to which the affected portion of the stomach is adherent.

2. By exciting around the ulcerated area a circumscribed abscess, which ultimately discharges its contents through the abdominal wall.

In cases resulting from disease, the place of the external opening depends somewhat on the region of the stomach in which the ulcer commences. If the disease is near the pylorus, the opening is generally near the umbilicus. If the ulcer is on the anterior surface, or near the fundus, the opening will be in the epigastric or left hypochondriac region. The margins of the opening, usually hard and rounded, are, when caused by cancer, ragged or even gangrenous ; the orifice is sometimes deeply retracted. The skin round the edges is red, tender, and often excoriated. The size of the opening ranges from something less than an inch to two inches. If very small, fluids only pass out ; if large, whatever is swallowed escapes.

Symptoms.—The general health is comparatively but little affected, the chief troubles being thirst, increased appetite, obstinate constipation, deficient urinary secretion, and amenorrhœa. The hunger is sometimes very distressing ; vomiting is exceptional.

Prognosis.—Patients have lived for many years with an open gastric fistula. If a gastro-cutaneous fistula be of cancerous origin, life must necessarily be short ; if the cause be a wound or simple ulcer, life may last for years. A traumatic fistula may last a few months and then close, or it may remain permanent.

Treatment.—1. The escape of the ingesta must, if possible, be prevented by the application, not of a plug, but of a suitable flat compress. 2. The surrounding skin must be carefully cleansed and dried before applying zinc ointment or oiled lint round the opening. 3. Granulation and cicatrisation must be encouraged by the approximation of the edges of the wound by the use of some well-adjusted compressing bandage, and the occasional employment of a stimulating application. Should nature's efforts have failed, the following operation, which will necessitate the patient being fed by the rectum for many days, has been suggested. A flap of skin is dissected off the neighbouring part, turned with its cuticular surface inwards and nicely fitted to the orifice, whose edges have been previously freshened.

BILIARY FISTULÆ.

External or cutaneo-biliary fistulæ are the result of (1) *gun-shot wounds*; (2) *blows over the liver*, leading to parietal adhesion of that organ, and then abscess; (3) *hepatic abscess* of non-traumatic origin; (4) *gall stones* sometimes, after leading to adhesions of the gall passages, and being discharged externally.

The gall bladder is the part usually affected. The fistula, when of traumatic origin, usually communicates with the liver; when the result of disease, with the gall bladder. The fistulous channel may be many inches long, very circuitous in its course, and may open either over the fundus of the gall bladder or in any part of the right hypochondrium, in the inguinal region, or at the umbilicus: to the latter point it is directed by the suspensory ligament.

Symptoms.—The discharge is not always pure bile; it generally consists of muco-pus, mingled with bile or blood. The quantity varies from eight ounces to two pints daily. If the cystic duct is obstructed, no bile can flow by the fistula; if the common duct is occluded, the jaundice which precedes the fistula generally subsides after the opening is established; in rare cases the gall ducts are patent, and bile escapes both by the fistula and with the stools. When the amount of bile lost is great, the patient dies marasmic. During the formation of a fistula due to gall stone, there is often great suffering, especially during the passage of the calculus, but the patient may enjoy good health before the fistula closes.

Prognosis. — The duration of these fistulæ is various. When the cause of the fistula is gall stone it usually closes soon after all the calculi have come away; when, however, the calculi are numerous and the fistula long and tortuous, the opening has continued for years, during which every now and then it shows a disposition to close, which is prevented by succeeding calculi. The fistulous openings are rather inconvenient than dangerous. In a large proportion of cases due to disease, fair health is enjoyed for years. The most unfavourable cases are those due to cancer or parenchymatous hepatic abscess. Complete healing may be anticipated when the calculus is single, the opening directly over the gall bladder, the discharge free from bile, and if there is no jaundice.

Treatment.—The opening and surrounding structures should be kept scrupulously clean. Operative measures are not advisable, save where there is much weakness from continual loss of bile, and then only when there is no obstruction to the common bile duct. If a calculus plug the fistula or can be felt near the orifice, it will be necessary to open up the fistula to allow of extraction of the calculus. A permanent fistula may sometimes be prevented by cholecystotomy. When biliary calculi remain behind, the fistula should be kept open to allow of their discharge at a future time.

Internal biliary fistulæ.—Fistulous communications may occur between the biliary passages and adjacent organs, as the stomach, duodenum, and colon, by a process of ulceration set up by gall stones.

Fistulæ have formed between the gall bladder and pelvis of the kidney, vagina, and portal vein. Cystico-duodenal fistula is likely to lead to impaction of the calculus and intestinal obstruction. Cystico-colic fistula is generally associated with cancer of the gall bladder.

The symptoms of cystico-gastric, and intestinal fistulæ due to gall stones, are usually obscure. Jaundice is rarely present. Vomiting, with more or less colic, and tenderness in the region of the gall bladder, are the commonest signs, with occasionally hæmatemesis and bloody stools.

FÆCAL FISTULÆ.

Fæcal fistula differs from "artificial anus" in having much smaller external and internal orifices, and consequently in not allowing the discharge of more than a small portion of intestinal contents through them, instead of the whole, or nearly the whole, as artificial anus does.

A fæcal fistula has a narrow, sometimes long and sinuous, track between its intestinal and outer orifices; whereas the internal orifice of an artificial anus may involve the whole lumen of the bowel, and is adherent to the parietal peritoneum, so as to be opposite the external opening, which is always cutaneous, instead of, as in fæcal fistula, communicating with another viscus. Fæcal fistulæ are sometimes "blind;" the fæcal matter which escapes burrowing in the retroperitoneal cellular tissue, or passing into an abscess cavity, instead of being discharged through a second opening. There is an intermediate form of fistula, in which the intestine communicates with an abscess, and the abscess with the surface. Fæcal fistulæ may communicate with any part of the bowel, and have more than one external and internal opening.

Causes.—Fæcal fistulæ may be congenital, and due to defects of development; or non-congenital, depending on pathological conditions.

Congenital fæcal fistula is occasionally due to persistence of the omphalo-mesenteric duct. This constitutes a rare form of umbilical fistula attended by a biliary or fæcal discharge. Congenital fistulæ may be associated with imperforate anus. When communicating with the vagina, the inconvenience is sometimes very slight; but when opening into the bladder or male urethra, the symptoms simulate those of vesical calculus and are consequently indicative of much suffering.

Non-congenital or pathological fistulæ.—They may be caused by (1) *external injury* in either of the following ways: (*a*) Perforation of both the abdominal parietes and intestine, the gut remaining *in situ*, and adhering to the parietal wound; (*b*) incomplete union following enterorrhaphy; (*c*) sloughing of a portion of gut which has been contused by a blow. (2) *Strangulated hernia* may, after reduction, ulcerate at a limited spot, causing a fistula either directly or through the intervention of an abscess. (3) *Abscess* arising from various causes. (4) Any disease of the bowel which causes *ulceration* or *sloughing*. (5) Imperfect radical cure of *artificial anus*.

Prognosis.—When due to a wound, a fæcal fistula generally closes spontaneously; when due to hernia, the prospect is favourable. Closure is very improbable in cases depending on obstruction.

Diagnosis.—The fæcal character of the discharge shows the source of an external fistula; and the passage of fæcal matter by the vagina, urethra, stomach, or lungs, indicates it in many of the internal. Blind fistulæ may, however, remain undetected for some time.

Treatment. — Cleanliness, light farinaceous solid food, enforcement of the supine posture, and some flat, equable compression over and beyond the fistula, are the main features of treatment. The application of zinc and spermaceti ointment on lint placed widely round the opening prevents excoriation. Warm lead lotion is most effective in relieving smarting irritation. Paring the edges, and apposing them with harelip pins and sutures, has been tried, as has also the use of caustics, but without success. When the fistula is in front of the abdomen, a large flat air pad attached to the centre of an abdominal belt exercises pressure very satisfactorily.

FOREIGN BODIES IN THE STOMACH AND INTESTINES.

By **foreign bodies** are meant such as are incapable of being influenced by the digestive processes. They may be divided into: (1) Pointed bodies, as needles and pins. (2) Elongated irregular cutting bodies. (3) Rounded bodies, as coins, thimbles, etc. (4) Hair, wool, cocoanut fibre, etc.

Symptoms.—Sometimes the bodies will pass the whole intestinal tract without producing any inconvenience. They may remain throughout life without causing discomfort. In other cases, especially if the bodies are pointed, they cause ulceration of the stomach or bowels, or pierce their coats and bring on peritonitis. Occasionally they escape entire through the abdominal wall.

Foreign bodies in the stomach.—The first symptoms are usually vomiting and pain in the epigastrium, succeeded by a sense of weight and fulness. Hæmatemesis or acute gastritis may occur. In some cases the presence of a foreign body may be detected by manipulation. Artificial teeth are the bodies most commonly swallowed by accident.

Treatment.—Aperients should be avoided. If the foreign body be one likely to pass through the canal, rest in the horizontal posture, and thick soup, eggs, etc., should be taken for a few days, when, if it has not escaped "per anum," a cathartic may be given. Should the substance become fixed across the rectum, gentle efforts may be made to extract it. When from its character it is unlikely to pass through the pylorus, and certain to damage any part of the tube in which it remains, *gastrotomy* should be advised and performed without delay. It should be remembered, at the same time, that extraordinary recoveries have followed the expulsion "per anum" of numerous and awkwardly shaped foreign bodies.

Foreign bodies in the intestines.—These may enter the bowel in the following ways:

1. They may be swallowed and pass on through the pylorus, in which case they rarely become subsequently arrested within the gut. Sometimes, however, fish bones have become impacted in the walls of the bowel and there set up abscess. In one case a patient had been complaining of pain in the rectum, especially during and after defæcation, and upon examination a piece of rough wood, about three-quarters of an inch long, was found impacted just within the internal sphincter. This was stated to have been accidentally swallowed with food.

2. After ulceration, biliary and other calculi and hydatids may enter the bowel, and cause obstruction, or be discharged "per anum."

3. Foreign bodies are sometimes introduced into the rectum by the patients themselves.

4. Bullets enter the intestine after penetrating the abdominal walls, but they generally pass "per anum."

The subsequent careers of foreign bodies which have entered the intestine are various. (1) They may remain without giving rise to any inconvenience;

(2) they may penetrate and be discharged through the abdominal walls; (3) they may pass "per anum"; (4) they may ulcerate through the walls of the bowel and escape into the peritoneal cavity; (5) they may become impacted in the bowel and destroy life by intestinal obstruction.

Foreign bodies in the large intestine.—It is by no means rare for foreign bodies to be impacted in the appendix cæci.

Though not often lodged in the large bowel, foreign bodies which have traversed the alimentary canal may become retained in the colon or rectum under the following circumstances:

1. When solid fæcal matter is deposited around the solid body.
2. When the body sticks in the walls or across the lumen of the gut.
3. When constriction of the bowel exists, due to stricture or the pressure of a tumour.

Treatment.—Enterotomy should be performed if the foreign body become impacted, threatening life from obstruction or perforation; or if it render existence miserable by its continued presence in the bowel; also if the body be long and of an angular shape, and not likely to pass the ileo-cæcal valve and cæcum.

Enterotomy.—This operation consists in cutting through the abdominal walls in the middle line, if the exact position of the impacted body is unknown. The portion of intestine occupied by the substance should be drawn to the surface of the wound, and when surrounded with properly prepared sponges, so that nothing may escape into the cavity of the peritoneum, should be opened by as small an incision as will admit of the extraction of the foreign body. When this has been removed by suitable forceps, or by the finger, and the wound in the gut sewn up by Lembert's, Jobert's, or the continuous suture, the intestine should be returned and the parietal wound closed by interrupted sutures passed through the whole of the abdominal walls, including the peritoneum.

GASTROTOMY.

This operation, must be distinguished from *gastrostomy.* (*See* Art. V., vol. iii.) Gastrotomy is performed thus: An incision is made longitudinally or obliquely over the stomach, by carefully cutting through the parietal strata down to the peritoneum, which should be punctured and divided upon a director. The position of the foreign body whose presence has necessitated the operation should be ascertained by passing the finger-tip over the surface of the stomach, whilst the stomach is retained *in situ* by forceps, or a ligature looped through the peritoneal and muscular coats. An opening should now be made into the stomach thus fixed, only large enough to allow of the extraction of the foreign body without injury to the parietes of the viscus. After withdrawal of the substance by polypus forceps or a blunt hook, the stomach wound should be stitched up with a continuous, or Lembert's, or Jobert's suture.

For two days before gastrotomy as little food as possible should be taken into the stomach. After the stomach wound has been stitched up, the wound in the abdomen should be closed as after ovariotomy. If the oblique incision be employed, it should commence below and a little to the left of the xiphoid cartilage, and should be continued for three and a half inches outward, and an inch below the margin of the costal cartilages. If the longitudinal incision be adopted, it should begin immediately below the margin of the thorax, and extend for four inches along the outer edge of the left rectus muscle. All bleeding from the divided edges of the parietes should be stopped before opening the peritoneum, and all hæmorrhage from the cut edges of the stomach before introducing the sutures. The after-treatment consists in keeping the shoulders and knees raised, applying absorbent cotton wool dressing or boracic charpie, and retaining it with a broad flannel binder. Nutritive enemata should be substituted for food by the mouth for three or four days after the operation.

AFFECTIONS OF THE UMBILICUS.

Epithelioma of the umbilicus.—This is a rare disease, but cases have been recorded where cancerous growths have been removed with successful results.

Large sarcomatous tumours are sometimes met with, and may be successfully removed, even though the peritoneum is extensively implicated.

Fleshy polypi of the umbilicus.—These originate in an error in cicatrisation; their size varies from that of a currant to that of a date stone or larger; their surface is moist, and they are generally more or less pedunculated and bright red, although they are sometimes wart-like, or resemble a granulation tumour. If the polypus is associated with a fæcal or urachal fistula, a probe may be passed for a long distance inwards through the small aperture on the summit. They rarely bleed seriously, but occasionally they give rise to dangerous, and even perhaps fatal hæmorrhage. *Treatment.*—This consists in ligaturing the pedicle and allowing it to dry up and drop off.

Hæmorrhage from the umbilicus.—There is a rare form of hæmorrhage from the umbilicus of new-born infants, which is almost always fatal. It is twice as frequent and more fatal in boys.

Its cause is due to jaundice, or to a transmitted hæmorrhagic or syphilitic dyscrasia. Hæmorrhage of a most intractable character may occur about the insertion of the cord before its detachment, but it generally occurs after the separation, and when the umbilicus is nearly cicatrised.

The treatment consists in the use of mild cathartics and anti-hæmorrhagic remedies. Compression and styptics are useful, but have been rarely permanently successful. The ligature of the umbilicus "*en masse*," with two needles transfixing it at right angles, offers the best chance of permanently arresting the bleeding.

ABDOMINAL ABSCESSES.

These are of four kinds.

1. Those between, and on the exterior of, the viscera of the abdomen; they are often the consequences of abdominal injuries which have given rise to localised peritonitis.
2. Visceral abscesses, or those which have originated in, and are confined to, the interior of some organ; such are hepatic, renal, splenic, omental, and biliary abscesses.
3. Parietal abscesses, those which occur between the layers of the abdominal parietes.
4. Retro-peritoneal abscesses.

Peritoneal abscesses are of two kinds, the circumscribed and the diffused.

Abscesses exterior to the organs and yet circumscribed occur in all parts of the abdomen and pelvis, and are walled in by fibrinous adhesions between viscera and parietes, or between two or more of the viscera, or two or more coils of intestines.

Causes.—Peritonitis leads in some parts of the abdominal cavity to a circumscribed collection of pus. The peritonitis may have been idiopathic, or the result of a blow, kick, sprain, or other injury; it may have followed some accident of parturition, and left behind an abscess in some distant part of the abdomen; or an abscess in the left hypochondrium has resulted from a general puerperal peritonitis. Other causes have been cancer, simple and dysenteric ulcers of the gastro-intestinal tube, gall stones, etc. Sometimes a visceral abscess situated near the surface of the organ will give rise to a circumscribed peritoneal abscess.

Course and symptoms.—Circumscribed peritoneal abscesses may occur at any age; may occupy any part of the peritoneal cavity; and are often multiple. The commonest and some of the most important are those situated between the liver and the diaphragm, and between the spleen, the stomach, and the diaphragm. In a large proportion of hypochondrial abscesses, the corresponding side of the thorax is affected; there may be pleurisy, pneumonia, or empyema. The liver or spleen may be injured; an abscess forms beneath the diaphragm; pleurisy then occurs, followed by adhesion of the base of the lung to the diaphragm; inflammatory effusion takes place; the lung is gradually compressed against the spine; at a later period the abscess bursts through the diaphragm, and an empyema is established. In other cases the abscess may discharge itself into the stomach or transverse colon. There will probably be evidence of severe inflammation, with rigors, following some injury; or coming on in the course of an illness connected with one of the abdominal organs; there will be high fever, local tenderness, and increased dulness on percussion followed by the appearance of a tumour. Intermittent attacks of severe abdominal pain may occur; there may be constipation and vomiting of blood.

Diagnosis.—Sometimes in diaphragmatic abscesses the chest symptoms altogether overshadow the abdominal. Attention must be given to the previous history, onset, and earlier symptoms of these obscure cases; and if it be borne in mind that they very frequently result from direct external injury, or by extension from some disease in a neighbouring organ, a correct diagnosis may often be made. The character of the tumour, when one exists, is not specially diagnostic. It must be remembered that the liver or spleen or some other organ may be displaced by the pus of a circumscribed abscess.

Prognosis.—This is usually unfavourable. When the abscess is caused by tubercular peritonitis, or by malignant disease of the uterus, ovary, or bladder, there can be no prospect of recovery. In subdiaphragmatic abscess, unless early exit be given to the pus, there is risk of perforation of the diaphragm, and secondary rapidly fatal mischief in the thorax. Death sometimes occurs suddenly from rupture into the general peritoneal cavity; sometimes in a fortnight or so from intensity of the inflammation, and in other cases from pyæmia, hectic, or exhaustion.

Treatment.—This is the same as that required for other abdominal inflammations until pus is suspected, when it should be searched for and evacuated by aspirator or trocar. Where a tumour presents itself, or the hypochondrium is bulged, an incision should be made, and the edges of the opening kept apart by a drainage tube. In cases where the abscess has pushed the diaphragm and lung far up, the pus may be evacuated by an incision in the seventh or eighth intercostal space without injuring the lung or pleura. Small hope of good from puncture can be entertained if the abscess have already burst through the diaphragm into the lung or pleural cavity.

In all cases in which the abscess cavity can be reached and drained, the sooner operative measures are adopted the better.

Diffused abscess of the peritoneum.—A form of suppurative peritonitis, in which the abscess cavity and peritoneal cavity are one and the same.

Causes.—Generally obscure. Typhoid and recurrent fever, chicken-pox, exposure to damp and cold, and suppurating mesenteric lymphatic glands have caused diffused peritoneal suppuration.

Symptoms.—After a period of abdominal illness the belly becomes irregularly swollen, of peculiar shape, and bulges prominently in the middle or one of the lateral regions. Dulness on percussion, tenderness, and subsequently a thrill may be detected at the prominent part. The varying temperature rises to 101° to 103° F. in the evening. The early symptoms may be shivering and vomiting. There may then be the appearance of an abscess in the parietes which may burst spontaneously, discharging pus at the umbilicus, and causing a fistula through which a probe can be passed into the peritoneal cavity. Or the presence of fluid will be suspected, and the introduction of an aspirating needle will be followed by the escape of some very fœtid pus.

Course and *prognosis.*—The chief danger is the liability of some of the pus to become encysted between one of the viscera and the diaphragm, and lead to sub-diaphragmatic abscess, with its serious consequences already alluded to. It may, after becoming encysted, break into the bladder or rectum, and cause death by hectic and exhaustion.

Treatment.—In the early stage, hot fomentations, opium, nutritious and easily digestible food. Evidence of the presence of pus, without any distinct indication as to its localisation, demands a cautious but free incision into the abdomen in the median line.

A drainage tube should be left in the wound, and if pus bags in places it should be gently mopped out by means of well-prepared carbolised sponges at the time of operation, but officious interference with adherent purulent lymph may lead to troublesome capillary bleeding. Laparotomy has been performed with a successful result.

VISCERAL ABSCESSES.

Hepatic abscess.—*Causes.* Contusions of the substance, unattended by laceration of the capsule of the gland, ruptures, and penetrating wounds of the liver may excite abscess.

Hepatic abscess has been known to follow operations for hæmorrhoids and fistula in ano, the cauterisation of cancer of the rectum, and violence in reducing rectal prolapse; also lithotomy. Abscesses so caused follow phlebitis, and are due to the transference of septic matters from the seat of operation to the liver, where they form embolic foci, the starting points of the abscesses. Amputations and compound fractures of the lower limbs have been followed by abscess of the liver. Any suppurating surface or cavity, and any ulcer may, through the medium of the systemic circulation, generate typical pyæmic abscesses of the liver. Hepatic abscess has been caused by hydatid cysts, and by the invasion of lumbrici.

Character and size.—These abscesses may be single or multiple, superficial or deep, encysted or quite undefined, with ragged and shreddy margins. The pus, frequently laudable, may be greenish, or reddish, and vary in quantity from a drachm to a gallon.

Symptoms.—Liver abscess is especially common in tropical and malarial districts. The liver not being a sensitive organ, a deep-seated abscess may attain serious dimensions without previously exciting peritoneal inflammation and pain, and if stoutly encysted may remain for years without producing marked constitutional disturbance. On the other hand, a small superficial abscess will cause severe hepatic pain, immediate rise of temperature, and increased frequency and tension of the pulse. If the abscess be near the upper surface, there will be a short dry cough, often attended by a friction murmur at the base of the lung; if it be near the under surface there will be vomiting or irritating diarrhœa; and if tending toward the outer aspect of the liver there will be fulness, and perhaps obscure fluctuation. The local signs are a sense of weight in the right hypochondrium, with inability to lie on the right side; frequent spasm of the rectus; tenderness over the liver area, and occasionally fluctuation. The complexion is muddy, and the tongue thickly furred; and rigors and night sweats are especially marked in infective abscesses. Except in abscess dependent on obstruction and ulceration of the bile ducts, jaundice is very rare.

Diagnosis.—Perihepatitis (inflammation of the liver capsule) is often confounded with abscess. Idiopathic perihepatitis simulates pleuritis more than liver abscess, and, unlike secondary perihepatitis, is not preceded for many days by the symptoms of abscess. Acute perihepatitis gives rise to sharp pain, fever, and local tenderness; whereas liver abscess is generally the cause of impaired general health for a long time antecedent to the development of the acute symptoms.

Hepatic abscess has also been confounded with distended gall bladder, with cancer, and with hydatid cysts of the liver; therefore careful palpation, percussion, and due attention to the clinical history of the patient are necessary.

Prognosis.—This is especially unfavourable if the abscess be of septic origin. Complete recovery may, however, take place if the pus finds an exit, though the discharge continue for many months. An important guide is the point at which the abscess is likely to burst. If rupture takes place into the pericardium or peritoneum death is certain, if into the pleura it is almost inevitable. Abscesses which open into the stomach, intestine, or lung, are the most favourable. If more than one abscess exist, the prognosis is very unfavourable.

Treatment.—The strength must be supported by tonics, nourishment, and wine. Hot fomentations, and leeches when not contra-indicated. Opium to relieve pain. On the occurrence of fluctuation, the aspirating syringe applied to a good-sized trocar and canula should be used, and the canula should be left in for some days. In many cases it is best to open the abscess by a free incision made below the ribs and as near the xiphoid cartilage as possible. A drainage tube should be used. In true infective abscesses, surgical treatment is of little avail. In tropical abscess a sea voyage is often very beneficial.

The sooner an abscess of the liver is opened after its existence and site are ascertained, the better.

Biliary abscess.—Abscess of the gall bladder and biliary ducts generally results from obstruction to the free passage of bile from simple or cancerous stricture of the duct, from biliary calculi, or from cancer or some other growth pressing upon the ducts.

Suppuration of the gall bladder.—*Symptoms.* Enlargement from suppuration is characterised by a more or less pear-shaped, elastic, sometimes fluctuating swelling in the normal situation of the gall bladder. It is painful and tender, and is accompanied by febrile symptoms, and frequently by rigors and night sweats. If the cause is obstruction of the cystic duct, there will be no jaundice; but jaundice will be present in obstruction of the common bile duct. There may be a history of biliary colic. The abscess may burst externally, and pus, and perhaps calculi, be discharged through the resulting fistula, or it may open into the duodenum, colon, or peritoneum.

Diagnosis.—Abscess of the liver so closely simulates suppuration of the gall bladder in many cases, that a correct diagnosis can only be made by inquiry into the history of the disease. Abscess of the gall bladder is relatively more common in those who have never lived in tropical or malarial districts. In well-defined cases, the swelling of the gall bladder is circumscribed, not surrounded by any degree of hardness, and always situated below the false ribs.

Prognosis.—Pyæmia and secondary abscess of the liver are most to be feared. The fistula, resulting from rupture of the sac, may remain open for an indefinite time, or may quickly close.

Treatment.—Rest facilitates adhesion of the inflamed gall bladder to the parietal peritoneum, and guards against the occurrence of general peritonitis. Opium, leeches, and warm fomentations relieve pain. Cooling salines and light nutritious diet are requisite.

As soon as suppuration has occurred, and the distended cyst presents a swelling, it should be opened directly by an incision, instead of an incision being first made down upon it, and then potassa fusa applied to erode it. It is advisable, however, after exposing the surface of the cyst, to empty it of its fluid contents by an aspirator, before cutting through its coats. The gall bladder should be drawn up into the wound by spring forceps, and when flaccid, its walls should be incised. After removal of the canula, the edges of the divided gall bladder should be stitched to the margins of the wound in the abdominal wall.

Abscess in the biliary ducts.—Calculi may give rise to abscess in the ducts, at any point at which they may become impacted, or excite inflammation.

Sometimes an impacted calculus excites an abscess in the adjacent liver tissue, and may, after a time, pass from the duct into the abscess cavity ; or inflammatory adhesions may form, and the calculus pass into a circumscribed peritoneal abscess ; or it may ulcerate inwards, giving rise to an intestinal or gastric biliary fistula.

Symptoms.—In intrahepatic duct abscess these are obscure; there is no jaundice, enlargement of the liver, or pain; but sometimes they cause a sense of weight about the liver, with occasional rigors, followed by sweating. Extrahepatic duct abscess causes biliary colic, hepatic tenderness, vomiting, and intestinal disturbance. If the common duct be the seat of abscess, there will be jaundice.

Treatment.—This consists in relieving pain, checking inflammation, and removing the obstruction, if possible, by giving non-depressing emetics. Surgical interference is rarely advisable.

Abscess of the spleen.—This rare affection is usually of embolic origin, due to blood poisoning. Diffused suppuration is sometimes a sequel to fevers.

The symptoms are often very ill defined. The treatment resembles that of abscess of the liver.

Abscess of the pancreas.—This is rarely met with. Metastatic abscess has followed disease of the testicle; a calculus in the pancreatic duct and perforating ulcer of the stomach or duodenum have caused abscess of the pancreas. The symptoms and local signs are those common to visceral abscess. Surgical treatment is of little or no avail, measures for the relief of urgent symptoms being alone practicable.

Perinephric abscess.—Suppuration of the cellulo-adipose tissue about the kidney may follow injuries not necessarily involving this organ. It occurs, too, quite independently of urinary extravasation.

It most frequently originates in suppurative pyelitis, or nephritis, by extension through the capsule. Renal calculus, vesical calculus, urethral stricture, or prostatic disease may be the primary cause. (*See* Art. XII., vol. iii.)

Symptoms.—These are similar to those indicative of deep-seated abscesses. A peculiar lameness, due to flexion of the corresponding thigh to relieve tension, is an important early sign. The presence of swelling, increased resistance, and obscure fluctuation in the affected loin, may be preceded by œdema of the foot and ankle.

The prognosis is always grave, but not necessarily unfavourable.

Treatment.—Dry or wet cupping, or blistering, may prevent suppuration. When matter is present, it should be evacuated through a free opening, made like the incision for colotomy. The general details of treatment are similar to those described for other visceral abscesses.

Fæcal abscess.—Fæcal abscesses may originate in fæcal extravasation *from* the bowel, or in ulceration *into* the bowel of purulent accumulations, which have been formed quite independently of intestinal mischief.

They may be extra- or intraperitoneal.

Causes.—Primary fæcal abscesses generally result from some obstruction in the bowel giving rise to perforation of the intestinal walls. Cancer, the pressure of some tumour or foreign body, ulceration by gall stones, and abdominal injuries, may cause primary abscess.

Secondary fæcal abscesses, those, namely, in which fæcal extravasation invades an abscess already existing, may arise from causes enumerated under the sections, "abscess of the parietes," "circumscribed peritoneal abscess," "retro-peritoneal abscess," and "ilio-pelvic abscess."

Special symptoms.—1. Fluctuation accompanied with a certain degree of resonance, or emphysematous crepitation.

2. The presence of pus in the stools, or the occurrence of putty-like stools or diarrhœa with coagula passed in the fæces, are significant of fæcal abscess.

3. The subcutaneous diffused cellulitis dependent on fæcal abscess is more phlegmonous, of wider

extent, and accompanied with more marked constitutional depression than that resulting from non-fæcal abscess.

Prognosis.—In primary abscess this will depend on the cause chiefly; in secondary fæcal abscesses it is rendered less hopeful by the abscess becoming fæcal.

Treatment.—The treatment of fæcal abscesses in their early stage does not differ from that of other abscesses. As soon as there are signs of fæcal extravasation or suppuration, a free incision and frequent changes of dressings are requisite. If the cause of the abscess persists, it should be removed if possible.

Ilio-pelvic abscess.—Ilio-pelvic abscesses may be *subperitoneal*, in which case they are rarely circumscribed; or *subaponeurotic*, situated between the fascia iliaca and iliac muscle, and circumscribed for a time, but subsequently burrowing to the front of the thigh, and possibly bursting into the hip joint, through the thin part of its capsule.

Causes.—They are most commonly the sequelæ of labour, but may be caused by injury, osteal inflammation, laceration of muscle, and extravasation of blood. Ilio-pelvic abscesses have been mistaken for pelvic peritonitis, ilio-psoas abscess, and psoas abscess.

The general symptoms are those common to other abscesses. Retraction of the thigh may exist as a special sign, but is not diagnostic, as it occurs sometimes in perinephric and in ilio-psoas abscess.

The *treatment* is the same as for other forms of abdominal suppuration.

Retro-peritoneal suppuration. — *Causes.* Wounds; sprains of fibrous tissues; cold, and poisoned states of blood; necrosis of ribs or pelvic bones; ruptures of cysts; and puerperal inflammations.

The *symptoms* resemble those of localised suppuration within the peritoneal cavity, and the diagnosis in chronic cases, and even in the acute form whilst pus is confined beneath the abdominal and pelvic fascia, is difficult.

The *prognosis* depends, of course, chiefly upon the direction the pus takes.

The *treatment* is the same as for other forms of abdominal abscess. In all cases the pus should be evacuated through an external opening if possible; but where there is distinct pointing towards the rectum or vagina, an opening should be made in their walls, and the pus withdrawn by means of an aspirator, the use of which may have to be repeated several times.

URACHAL ABSCESS AND FISTULA.

The urachus is occasionally patent at the time of and after birth; very frequently the urachus at birth is tubular for a short distance above the bladder, but in after life it becomes a mere fibro-muscular cord. The urachus retains the tubular character of the allantois till about the thirtieth week of fœtal life.

The kind of orifice is not the same in all urachal fistulæ.

1. In some, a button-like papillary projection at the umbilicus, having an orifice at its summit, has been described. This has been kept constantly moist by a slight discharge having the odour of urine.

2. The urine may escape at several points on the surface of a hernial protrusion.

3. The orifice may be a mere deficiency (circular, oval, or irregular) in the linea alba.

4. It may be situated in a cup-like depression of the navel, or hidden from view by the falling together of the skin of the umbilicus.

5. The external covering of a hernia at the umbilicus is mucous membrane, which becomes pale and dry after prolonged exposure. The fistulous opening is at the side or on the summit of the hernia. In some

cases the protrusion acts like a plug, to prevent the continual escape of urine, but is withdrawn during the act of micturition by the traction of the vesical muscular fibres, and thereupon urine is ejected at the fistula as well as along the urethra.

6. The fistula may be indirect. It will probably be so when an abscess precedes it. In one case there were pain in the lower part of the abdomen, with frequent desire to micturate, and conditions very similar to those caused by the presence of a calculus in the bladder. Afterwards there was a discharge of pus, and of nearly all the urine, through the umbilical fistula.

Urachal fistulæ may either be *congenital* or *non-congenital.*

When preceded by an abscess, the fistula is non-congenital; and in some cases where there has not been an abscess, the fistula is not congenital, though in all, the defect which predisposes to it, namely, the non-obliteration of the urachal tube, is of course congenital.

Mode of origin of non-congenital fistula.—When the lower end of the urachus remains open, some of the urine is forced into it at the commencement of each act of micturition, especially of straining micturition. If the bladder becomes in course of time inflamed, the straining in micturition will increase the dilatation of the urachus. If the vesical orifice of the urachus becomes very minute, or even closes, the tube may be converted into a shut sac; and then, if any urine or mucus is enclosed within it, inflammation and abscess will be caused, and the abscess may either burst spontaneously or be opened by the surgeon at the umbilicus, where it points. A non-congenital fistula may thus be formed, independently of any mechanical obstruction, at the neck of the bladder or in the urethra.

When an abscess occurs after the obliteration of the vesical end of the urachus, and opens at the umbilicus, the resulting fistula is non-congenital, and may or may not be complete or urinary, according as there is, or is not, a communication between the abscess and the bladder.

Complications of urachal fistula. —Some of the complications are in part causes, others are results, and others, again, merely coincident. Polypus of the bladder, urethral calculus, phimosis, congenital stricture, and everything which prevents the free discharge of urine by the natural passage, are only in part causes, as there must be also an imperfect closure of the urachus to permit of a true urachal fistula. When this patency does not exist, the bladder, ureters, and kidneys may all become sacculated without any tendency being shown to dilatation or re-opening of the urachus. This is proved by cases of congenital hydro-nephrosis.

Prognosis.—When the fistula is congenital, and caused by some obstruction to the outflow of urine, the prognosis is unfavourable, as death from renal disease is likely to result, unless the source of obstruction be removable like phimosis or urethral calculus.

When the fistula is non-congenital and follows cystitis or abscess, the health of the patient will have been probably greatly destroyed before the fistula is established, and death will subsequently occur from exhaustion, cystitis, or pyelo-nephritis. Simple patency of the urachus without urinary obstruction, though inconvenient, need not interfere with life.

Treatment.—When phimosis exists, circumcision should be performed. When a calculus is present it must be removed. If cystitis exists, dilatation of the urethra in the female, and median external urethrotomy in the male, will assist in relieving the cystitis if it does not cure the fistula.

If the umbilical orifice is a vent for pus or urine which cannot easily pass by the urethra, no attempt to close it should be made. When the opening is on a papillary outgrowth, it is sometimes sufficient to apply a ligature round the base of the papilla, which will soon dry up and fall off, leaving the fistula permanently closed. In other cases, nitric acid or the cautery may be applied to freshen the edges of the orifice and start healthy granulations. In some cases, dissecting off the skin around the opening, and bringing the raw surfaces together with hare-lip pins, has proved very successful.

FALSE ANUS; COMMONLY CALLED ARTIFICIAL ANUS.

The term "artificial anus" is ill adapted for those varieties of abnormal openings of the bowel which are not the designed result of surgical operation, and to designate which the term "false anus" is more appropriate and correct.

The characteristics of a false anus are: (1) The escape of the greater part or whole of the fæcal matter; (2) the absence of voluntary influence on the part of the individual to retard the escape; (3) the increased prolapse, during the discharge of fæcal matters, of the already protruding and swollen mucous membrane of the ends of the intestine; (4) the ends of the bowel are adherent to the surrounding parts by false membrane.

Situation.—As a result of external violence, a false anus may occur in the loins, hypochondria, umbilical, iliac, hypogastric, or sacral regions; but when the consequence of disease it most commonly affects the inguinal and scrotal regions.

Any point in the intestine may be the seat of the internal opening, but it is most frequent in a part which, being free to reach the hernial apertures, can thus be strangulated by them, consequently the ileum is most frequently affected.

Causes.—(1) *Hernia*, which has been operated on too late or not at all, gives rise to false anus by ulceration, which may be combined with abscess; (2) *wounds*, especially in war; (3) *foreign bodies*, which, being arrested, lead to perforations, followed by fæcal abscess or false anus; (4) *abscess* commencing in the parietes, or in ulceration of the intestinal mucous membrane; (5) *congenital defects* sometimes cause a false anus situated at the umbilicus or lower down the linea alba; (6) *error in diagnosis;* a fæcal impaction has been incised in mistake for abscess.

Pathological anatomy.—The external orifice varies much in size and appearance. It is usually single, but may be double or even cribriform.

The distance between the lower edge of the intestinal aperture and the outer opening, which is usually from one-third of an inch to one inch, but may be even three inches, varies with the cause of the affection and the thickness of the abdominal wall. The two ends of the bowel are sealed by plastic lymph to the parietal peritoneum around the outer orifice, and thus the serous cavity is shut off. The adhesions are from one-twelfth to one quarter of an inch wide. When false anus results from disease, adhesions precede the sloughing; but when of traumatic origin the adventitious barrier has to be thrown up round the site of injury. The adhesions never extend far along the extremities of the bowel, which have between them a cul-de-sac, into which the pressure of the viscera occasionally forces a hernia. The contiguous ends of the bowel which are thus attached to the deep margin of the external opening may be very obliquely placed with regard to one another, or they may be quite parallel. They may terminate in bending more and more, to become lost in the convolutions of the intestinal canal. Each end of the gut opens by a distinct orifice separated by a spur, or septum, termed the "éperon," or "promontory."

Symptoms.—Fæcal matter, mucous substances, and intestinal secretions are discharged through the abnormal opening. Colicky pains are frequent, and in old long-standing cases callosities occur from the inflammation caused by the constantly escaping matters. The nearer the stomach the intestinal opening is, the less fæculent and more chyle-like will be the discharge. Loss of strength, rapid emaciation, and death from inanition occur in many cases.

Terminations.—Patients may live with a false anus for several years. Death may occur from inanition, or from rupture of the bowel and fæcal extravasation into the peritoneum, or from strangulation of the ends of the intestine.

Complications.—Prolapse of one or both orifices may occur; that of the upper orifice is the most frequent and extensive, sometimes attaining a length of eight or ten inches.

Treatment.—This may be considered under the heads of palliative and curative means.

Palliative treatment.—Pressure of a truss so applied as to allow of the periodical evacuation of the bowel. The adaptation of a receptacle, of which numerous patterns in several materials have been tried. Colomb's plan of making the upper end communicate with the lower by means of a curved gum elastic tube, two or three inches long.

Curative measures. — 1. *To remedy any existing complication* by: (*a*) careful dieting; (*b*) an occasional evacuation by enema; (*c*) relief of prolapse by position and pressure; (*d*) prevention of premature closure of external opening which would lead to intestinal obstruction.

2. *To diminish or remove the obstruction* caused by *the éperon* by : (*a*) Compression of the éperon by Desault's plan, viz. dilatation of the lower part of the bowel by the introduction of long tents. (*b*) Perforation of the éperon by a seton in cases where perfect adhesion has taken place between the two serous layers of its coats. (*c*) Destruction of the éperon by Dupuytren's enterotome

3. *To obliterate and close the external opening* by : (*a*) Pressure of a large elastic truss. (*b*) The use of caustic, or the thermo-cautery. (*e*) Suture after vivifying the edges. (*d*) Auto-plasty, covering in the opening by a piece of skin detached from the neighbourhood, and united by threads to the external aperture.

4. Another method of cure consists in *resection and circular suture of the intestine* in suitable cases.

CANCER OF THE PYLORUS.

This disease, which is of rare occurrence before middle life, and usually of the scirrhous form, is characterised by the cancerous cachexia, pain, vomiting of frothy liquid containing sarcinæ. There is dilatation of the stomach, and on palpation and manipulation a lump of irregular contour and stony hardness, more or less fixed, is detected a little below the right lobe of the liver ; in the early stage the mass is often freely movable.

EXCISION OF THE PYLORUS.

Pylorectomy has as yet been performed almost exclusively in cases of cancer ; but it has twice proved successful in cases of simple chronic gastric ulcer, and once for stricture of the pylorus following perforating ulcer. It should not be attempted in non-malignant conditions unless the disease, if left alone, will probably assume dangerous proportions ; nor in cancer, unless the growth is freely movable, and the disease uncomplicated by the presence of jaundice, ascites, or evidences of secondary deposit; nor unless the patient's health is such as to render recovery possible.

The operation.—The stomach having been previously well washed out, an incision four or five inches in length is made through the parietes, (*a*) parallel to the right costal margin; (*b*) transversely over the most prominent part of the tumour; or (*c*) longitudinally a little to the right of the linea alba.

All bleeding points having been secured, the peritoneum is to be incised, and the fingers introduced to explore the surroundings of the mass. If the growth has invaded or become adherent to neighbouring viscera, or involved the larger portion of one of the curvatures of the stomach, or widely implicated the lymphatic glands, the operation must be abandoned. If the operation, however, is continued, the next step is to detach the stomach from the greater and lesser omenta; the division of the omenta should be made step by step, between two pairs of pressure forceps. Any infiltrated glands should be removed. A flat antisepticised sponge should be placed beneath the diseased structures, to protect the peritoneum while they are being cut away. The walls of the stomach should be now divided obliquely with scissors, beginning tho section from the lesser curvature. Many ligatures may be required to stop the bleeding, and must be applied as indicated at each stroke of the scissors. The pylorus, held by a loop of silk passed through the serous and muscular coats, is next to be separated from the duodenum, which may be prevented from slipping back into the abdomen by passing a loop of silk as through its serous and muscular coats. The diseased mass having been excised, the cut edges of the stomach in part of their length should be joined by sutures, care being taken that the serous coats are co-adapted. In attaching the duodenum to the rest of the edges of the stomach wound it is best to begin at their posterior walls. From forty to sixty sutures have often been used for this purpose. The parietal wound should be closed by interrupted sutures, salicylic or absorbent wool should be bandaged over the abdomen, and the patient ought to lie with the knees raised.

After-treatment.—Nutrient enemata must be administered every few hours for the first two days, and the mouth may be moistened with an occasional teaspoonful of iced water or milk. After this period small quantities of fluid nutriment may be given at frequent intervals before light solid diet is allowed.

Dangers of the operation.—Shock and collapse are the most frequent causes of death. Secondary hæmorrhage is a source of great danger. The greatest difficulty during the operation is the separation of the adhesions.

HYDATID CYSTS OF THE LIVER AND OTHER VISCERA.

A hydatid, or an *echniococcus cyst*, is the larval form of a tapeworm (tænia echinococcus) infesting the intestines of dogs and wolves, and results from the ingestion of the tapeworm eggs, which are swallowed with impure water.

A hydatid tumour consists of (1) a thick, gelatinous, laminated, translucent bladder, the ectocyst. (2) A delicate membrane lining the ectocyst, having on its inner surface crowds of minute white granular bodies; the essential part of the hydatid, the "endocyst." (3) Very minute buds or gemmæ, produced by the last-mentioned structure. (4) An alkaline, clear fluid, with sp. gr. of 1007 to 1009, which distends the endocyst, and in which float a number of secondary vesicles, "daughter cysts."

An investing adventitious capsule freely supplied with blood, and of inflammatory origin, glues the ectocyst to the organ or structure in which the tumour occurs.

Hydatid cyst of the liver.—*Symptoms.* The growth of the tumour is insidious, and, though not larger than an orange when first detected, may gradually fill the greater part of the abdomen. The tumour, when single, is smooth, regular, elastic, and, if only covered by a thin layer of liver substance, may impart a sense of fluctuation and vibratory thrill on palpation. Except from its weight and pressure on surrounding parts, and consequent occasional dyspnœa, it causes no local inconvenience until it occasions inflammation of its peritoneal covering. Œdema of the lower limbs, hæmorrhoids, and other evidences of venous pressure, together with functional disturbance of other viscera, though exceptional, are nevertheless occasionally met with.

Diagnosis.—The slow and insidious character of the growth, and the absence of pain and constitutional symptoms, would serve to distinguish a simple uninflamed hydatid cyst from *hepatic abscess.*

Its diagnosis from *distended gall bladder* is not always easy. The shape, position, and its usual mobility in a lateral direction, together with attacks of biliary colic and jaundice, are significant of the latter condition. *Cystic and soft solid tumours of the kidney* generally first present themselves in the loin, or, if in the front of the abdomen, then lower down than the hepatic region. The absence of urinary change and of renal functional disturbance, however, does not exclude the possibility of a tumour being connected with the kidney.

Effusion into the pleura, attended with bulging of the ribs and intercostal fluctuation, might be suspected, but a physical examination of the chest and the absence of constitutional symptoms would indicate the hydatid nature of the swelling. In *ascites* the percussion dulness varies with posture. The character of the fluid aspirated will reveal or negative its hydatid origin.

Progress and modes of termination.—Hydatid tumour of the liver may continue throughout life without causing trouble or even causing a suspicion of its presence. On the other hand, if left to itself it may go on growing till it bursts or causes death by pressure. By its pressure it may excite fatal pleurisy peritonitis, or pneumonia. The various consequences which may follow its rupture, depending on the direction in which it bursts, need not be detailed. Rupture of the cyst, after adhesion, into the stomach or intestine, though not common, is the most favourable termination. The tumour may form adhesions with the parietes, ulcerate, and discharge externally. The cyst may suppurate and cause death by pyæmia. It has been stated that these tumours sometimes undergo so-called spontaneous cure, the fluid being absorbed and the contents generally being converted into a putty-like material, and the cyst wall thickening into a cartilaginous membrane.

Treatment.—Where the tumour is visibly increasing and producing discomfort by its pressure upon neighbouring organs, and to prevent the risk of rupture, it should be tapped with a small aspirating trocar and canula, the puncture being covered with a piece of absorbent cotton wool and collodion. If the fluid is not quite clear at the first puncture, or if it reaccumulates or if suppuration sets in, a deliberate incision should be made into the cyst, and the edges of the cyst or liver stitched to the abdominal wall. Electrolysis has proved successful in cases of small hydatids occurring in young subjects.

Hydatids of the spleen.—The recognition of the hydatid nature of the tumour will rest upon the same evidence as in hydatid of the liver. The diagnosis is difficult, and the treatment should be based on the same principles as those laid down in the case of the liver.

Hydatids of the kidney.—In some cases no symptoms exist; in others there may be renal colic, followed by discharge of hydatid vesicles per urethram. Hydatid cysts of the kidney, like those of the spleen, are often secondary to liver hydatids.

The treatment is similar to that described in the case of hydatid of the liver.

Hydatids of the mesentery and omentum, of the abdominal parietes, and between the bladder and rectum are sometimes met with. When occurring in the last-named situation they cause pain, œdema of the lower limbs, difficulty of defæcation and micturition, and sometimes complete retention of urine.

EXTIRPATION OF THE SPLEEN.

The cases most suitable for splenectomy or splenotomy are those in which the spleen is involved in an injury, and the gland is, it may be, protruding through the abdominal wound.

When splenectomy is performed for disease, floating spleen, simple hypertrophy, and enlargement from malaria give the best results.

For leucocythæmia splenectomy should not be performed.

Mode of performing the operation.—An incision varying in length from two to ten inches, according to the size of the injured or diseased organ, is made downwards in a line extending from the left eighth rib along the linea semilunaris. All parietal hæmorrhage having been stopped, and the peritoneum opened, the omentum, which will probably be found lying over part of the spleen, must be pushed on one side, and if the operator's hand encounter any adhesions, they must be broken through with the same care to prevent hæmorrhage as in ovariotomy, clamping and ligaturing as their separation is proceeded with. The organ is then to be raised out of the abdominal cavity, lifting generally the lower end out first, and taking care not to lacerate the soft capsule and parenchyma, which is so liable to bleed freely.

The spleen having been withdrawn, a clamp should be fixed upon the pedicle and the mass cut away. The pedicle should be ligatured in two or more parts with strong twisted silk or whipcord; the clamp removed and the ligatures cut short and dropped back into the abdomen. All blood should be removed from the abdominal cavity by antiseptic sponges. The intestines must not be allowed to protrude at the wound. The external wound is then to be closed with interrupted sutures, as after ovariotomy; and the wound should be dressed with some light antiseptic material. The abdomen should be supported by a flannel roller. After the operation the patient must lie on his back with the knees slightly raised on a pillow; and the urine should be drawn off every five or six hours. The dieting should be the same as after other abdominal operations.

Dangers of the operation.—Hæmorrhage may occur from a large vessel in the omentum at a spot where it is adherent, or from rupture of some large vessel, as the splenic vein. Part of the pancreas may be included in the clamp if care be not used. Severe disturbance of the sympathetic nervous system is sometimes witnessed, as is also persistent vomiting.

GALL STONES.

Structural characters and mode of origin.—Gall stones probably result from precipitation from the bile, either as the effect of a diminished amount of cholate of soda or as a concretion around inspissated mucus or blood clot.

They are composed of cholesterine, bile pigment, and earthy matter; the centre is often black, from which radiate lighter lines. When composed of pure cholesterine, these concretions are translucent and crystalline. When packed in the gall bladder in large numbers they become polygonal and faceted from mutual pressure.

Symptoms of distension of the gall bladder with calculi.—The tumour so formed is hard, nodulated, and resisting, imparting, on palpation, a crackling sensation. Usually movable, and sometimes the seat of much pain, the swelling increases in bulk only very slowly. Jaundice and a history of biliary colic are of common occurrence. Vomiting frequently occurs, and is occasionally very difficult to check. Attacks of agonising colic sometimes occur at regular intervals throughout the course of the case. Mental depression and hypochondriasis, and symptoms of disease in distant structures, are apt to be met with in nervous subjects. If ulceration be set up, localised peritonitis with acute pain must be looked for.

During the attacks of gall stone colic the pulse is generally small, and the condition of the system indicates prostration. The severe griping pain which a single calculus sometimes causes during its transit down the bile duct often suddenly ceases on its escape into the duodenum.

Treatment.—The attacks of spasmodic pain and vomiting caused by the presence of gall stones require for their relief the application of poppy-head fomentations, and, perhaps, belladonna ointment over the hepatic area; subcutaneous injections of morphine are beneficial; hydrocyanic acid, with chloric ether, may be given internally; and cautious inhalation of chloroform may be tried in severe cases. Where there is a possibility that the distension of calculi may prove fatal by the alarming constitutional disturbance caused, operative measures will be necessary, with the view of removing the impacted concretions.

Cholecystotomy.—This term, which is applied to the operation designed for the extraction of impacted gall stones by incision of the gall bladder, does not include the dilatation of fistulous openings.

Methods of operation.—1. *Maunder's.* The gall bladder, having been stitched to the parietes, is not opened until adhesions have had time to form.

2. *Marion Sims's.*—The cyst is stitched and opened at one operation.

An incision from three to four inches long is made either in the linea alba or over the outer border of the right rectus, or over the prominence of the tumour parallel to the linea alba. All bleeding must be stopped before opening the peritoneum. The gall bladder on being exposed should be emptied of its fluid contents by the aspirator, and then incised at the point of puncture, so as to readily admit the finger. The cut edges must be held well up into the external wound to prevent any of the contents of the cyst escaping into the peritoneal cavity. The interior of the cyst should be well cleansed with minute pieces of sponge on holders, and any movable calculi extracted with ring forceps. The edges of the wound should then be stitched with the continuous, or interrupted, suture to the upper end of the abdominal wound, leaving the opening in the gall bladder quite free. Finally, the rest of the abdominal wound should be closed in the usual way, and dressed in the manner described elsewhere.

The points specially requiring caution in performing cholecystotomy are the following:

1. No part of the wall of the gall bladder should

be cut away else troublesome hæmorrhage may ensue.

2. Great caution must be used in any attempt to dislodge stones impacted in the neck of the gall bladder or its duct, or encysted in its walls, lest perforation should allow bile to escape into the peritoneum.

3. If the calculus is adherent to the mucous membrane of the gall bladder, extreme care and delicacy of manipulation are necessary, to avoid laceration of the cyst wall.

4. No attempt should ever be made to close up the incision in the gall bladder, so as to return the viscus to the abdomen.

5. The operation should not be too long delayed.

INTESTINAL OBSTRUCTION.

Obstructions of the bowel may be *acute* or *chronic*. Following the description of the late Dr. Hilton Fagge, the *causes* of intestinal obstruction may be classified as follows :

1. *Plugging of the bowel* by gall stones, intestinal concretions, masses of ingesta, etc.

2. *Intussusceptions or invaginations ;* in these cases the bowel is plugged by another portion of intestine, which itself becomes subsequently strangulated by the pressure to which it is subjected.

3. *Interstitial disease* of *one or more of the intestinal tunics*, ultimately narrowing the lumen of the gut. These conditions cause *strictures*.

4. *Disease commencing external to the coats of the intestine*, and causing obstruction, not merely from stricture, but partly from adhesion of one coil of intestine to another, or to some adjacent structure ; or from puckering and contraction of the mesentery. These are cases of *contractions*.

5. *Twistings*, or *foldings of the intestine* (*volvuli*).—The obstruction, or strangulation, is simply due to pressure of adjacent portions of the bowel or its mesentery.

6. *Internal strangulations.*—The constricting agent has no structural connection with the circumference of the intestine strangulated, but is independent of it, and invested with a distinct peritoneal covering.

Diagnosis as to the seat of obstruction.—1. The more acute the pain, and the more rapid the course, the more probable is it that the *small intestine* is the seat of obstruction.

2. The early occurrence of severe vomiting, the scanty urine, and the early, but not excessive, distension, also point to this portion of the bowel as the seat of mischief.

Obstruction of the bowel by gall stones, intestinal concretions, etc.—Complete intestinal obstruction of a fatal character is comparatively rarely caused by impaction of gall stones or other intestinal contents. Where death is caused by the presence of such bodies in the "appendix cæci," or in a diverticulum of the lesser bowel, it is due generally to peritonitis, the result of ulcerative perforation.

Among the rare cases of intestinal obstruction due to plugging by contents, the larger proportion are the result of presence of gall stones, and almost invariably affect women.

Symptoms.—In cases of obstruction due to lodging of a large gall stone, the earlier symptoms are pain in the right hypochondrium, occasional vomiting of bile and gastric fluid in large quantities, with irregularity of the bowels. As the condition proceeds, the pain radiates from the hepatic area, but is not necessarily accompanied by tympanites or much tenderness of the abdomen; the vomiting becomes frequent and distressing, and ultimately very offensive. The amount of urine secreted becomes less, and the bowels cease to act. Death, under such circumstances, will most probably be induced by coma in the course of a few days.

Intussusception or invagination of the bowel.—This most frequently occurs at the ileo-cæcal valve, but it may be met with in the ileum or in the large intestine. The portion of intestinal tract involved in an intussusception arranges itself in the form of three cylinders. The outer is composed of the lower part of the intestine; the middle is inverted and reflected within this, the mucous surfaces of the two being apposed. Within the latter is the entering tube, the serous aspect of which is in contact with that of the reflected cylinder. The space between these is occupied by the mesentery of the entering and reflected tubes (Fig. 15). The length of the tract invaginated may be not more than two inches in the small bowel, whereas in the large intestine it may measure some feet.

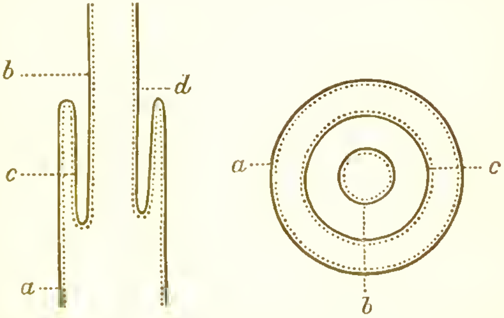

Fig. 15.—Vertical and Transverse Sections of an Intussusception.

a, The sheath or intussuscipiens; *b*, the entering or inner layer; *c*, the returning or middle layer. The dotted line indicates mucous membrane. (From Treves' "Intestinal Obstruction.")

Causes.—Intussusceptions have been caused by the irritation set up by "ascaris lumbricoides," and other varieties of intestinal worms. The straining, due to the presence of a polypus growing in the bowel, or a tumour pressing upon some part of it, may be a cause, as may also dysentery. Cases have been attributed to external violence, such as kicks, muscular strains, etc.

Symptoms.—Spasmodic attacks of abdominal pain, and tenesmus, which recur at varying intervals, and are accompanied by a discharge of mucus and bloody matter. Vomiting also occurs, and may become fæcal. Obstinate constipation and tympanitis are among the usual symptoms. The pulse is small and rapid, and the tongue furred.

Although the occurrence of an intussusception may be evidenced by the above symptoms, coming on almost simultaneously, still there are cases on record in which the signs of acute obstruction have not shown themselves for some months after the commencement of invagination of the bowel. The tumour resulting from intussusception is usually felt through the abdominal parietes as an irregularly ovoid or sausage-shaped doughy mass, varying in position as the invagination proceeds.

Intussusception is most commonly met with in children.

Diagnosis as to the seat of intussusception.—The bowel may be simply invaginated, or invaginated and strangulated as well.

When the small intestine is the seat of mischief, strangulation usually follows closely upon invagination, and the consequent symptoms and progress of the case are definitely marked; whereas in a case of ileo-cæcal intussusception, although strangulation may prove rapidly fatal at the commencement, months may precede the occurrence of alarming symptoms.

In Dr. Hilton Fagge's opinion the following are the differential characters which serve as a basis of diagnosis between intussusception affecting the ileo-cæcal area and that involving the small intestine.

Ileo-cæcal intussusception.	Intussusception of small intestine.
(1) Tumour felt in some part of colon, finally descending into left iliac fossa, and at a late period detected in rectum, or even protruding at anus.	(1) Tumour (if present) situated to right of umbilicus, and smaller.
(2) Tenesmus, straining, and voiding of bloody mucus. Copious hæmorrhage *occasionally* occurs, especially in infants.	(2) Discharge of large quantity of blood, some of which may be vomited.
(3) Violent paroxysms of pain may occur for months before the development of other symptoms, the patient being well in the intervals. The symptoms may, on the other hand, all occur rapidly at the first, and be followed by death within three or four days.	(3) The gradual increase of the symptoms occupies a period of eight or ten days, and there is a possibility that the affected part may be thrown off and recovery ensue.

Treatment.—In cases of intussusception of the large intestine, inflation by injecting air into the rectum has proved successful occasionally. Natural recovery by sloughing away of the affected portion of bowel is rare.

If there is reason to believe the intussusception involves a portion of the large intestine, and is free from strangulation, and there seems no hope of a spontaneous cure, laparotomy should be performed. The abdominal cavity having been opened in the usual manner, the sausage-shaped tumour should be brought out and reduced by kneading, and drawing down the outer tube or sheath. If, however, reduction cannot be effected, an artificial anus may be made, or, if the patient's condition permit it, the intussuscepted portion may be cut off, and the two ends of the bowel brought together by sutures.

Interstitial disease of the intestinal walls narrowing the lumen of the gut. Strictures.—From the statistical records of cases of intestinal obstruction due to a growth within the wall of the bowel, or affecting its mucous lining, it would appear that death due to such a stricture situated in the small intestine alone is extremely rare, and that the parts of the large bowel most frequently involved in stricture caused by disease, are the last two-thirds of the colon and the rectum.

The form of constricting interstitial disease is very generally cancer (Fig. 16).

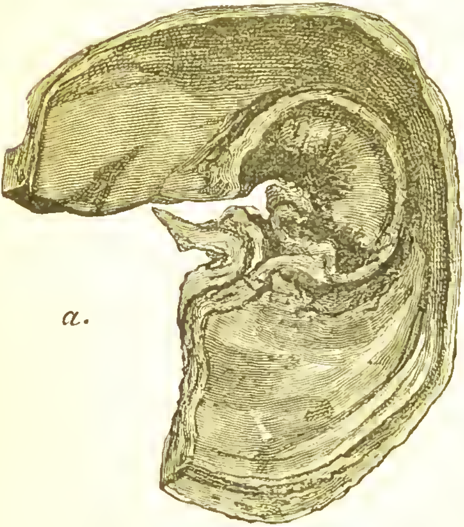

Fig. 16.—Epithelioma of the Colon. Bird's-eye view of the interior of the bowel. (From Treves' "Intestinal Obstruction.")

At *a*, a triangular piece of the intestine has been cut away.

It has been frequently observed, that in cases of stricture of the left side of the large intestine, the fæcal accumulation is greater in the cæcum than in the tract of bowel intervening between it and the seat of disease, and that consequently ulcerative inflammation of the cæcum results.

Symptoms.—These are *usually* of a chronic nature. A confined condition of the bowels may be noticed for a considerable period before absolute constipation occurs, and a long interval of time may further elapse before the development of other symptoms.

The pulse is tranquil, the urine copious, and the occurrence of vomiting delayed.

Diagnosis.—If upon examination of the rectum no cancer or stricture can be detected by the finger, while the symptoms indicate the lower part of the bowel as the seat of mischief, chloroform may be administered, and the whole hand introduced. A narrowing of the volume of the fæces is an important sign in some cases. The quantity of fluid which can be injected by enemata may afford some criterion as to the seat of stricture, the amount received by the bowel increasing in proportion to the distance from the anus; but the dependence placed upon such an aid to diagnosis must be very guarded.

The form of the abdomen in some instances is a guide to the position of a stricture. In a case of cancer at the hepatic flexure of the colon, the cæcum and ascending colon were distended, but the descending colon was not. Occasionally the loin on the side corresponding to the obstructed bowel may be felt to be somewhat fuller than that on the other side. But too much reliance must not be placed on the contour of the belly as an indication of the position of a stricture.

Disease commencing external to the coats of the intestine, and causing obstruction not merely from stricture, but partly from adhesion of one coil of intestine to another, or from puckering and contraction of the mesentery. *Contractions.*

Intestinal obstruction occurring as above is much more frequently met with in the small bowel than in the large, and is often the result of cancerous peritonitis.

Symptoms.—Paroxysms of abdominal pain, lasting a few minutes at a time, but of frequent occurrence and accompanied by visible coiling of the intestines; gurgling is often heard; there is usually no vomiting or marked abdominal distension, or prominence in the regions of the colon. Neither is there, as a rule, complete constipation. These conditions negative the probability as to the large intestine being the seat of mischief, and as true strictures are comparatively rare in the small intestine, the inference is that the cause of chronic obstruction with such signs is contraction caused by external disease or mesenteric adhesion, and its situation is in the small intestine. Distinct peristaltic movements of the intestines have been observed in some cases, and as they are rarely, if ever, visible unless the intestine above the seat of obstruction be hypertrophied, they indicate that an obstruction which otherwise appears acute, is nevertheless in all probability chronic.

Folds and twists of the intestine (volvuli).—Obstruction is sometimes caused by a twisting of the bowel upon itself so that its lumen is closed by the pressure of a part of the intestine continuous with it, or of its mesentery.

Course and symptoms.—There are usually great swelling and tension of the abdomen, and tympanites. Pain, especially intense over the region of the colon, occurs in paroxysms.

Severe vomiting sets in; the patient has an anxious expression, a cold, clammy skin, a rapid pulse, and a furred tongue.

The symptoms, however, in different cases of volvulus are so varied that they constitute a comparatively insecure basis on which to form a diagnosis as to the source of mischief in any given case of obstruction of the bowel being a twist of intestine or mesentery. It is the extreme severity and rapidity of the symptoms, rather than their individual character, that tend to distinguish volvulus from other forms of intestinal obstruction. In chronic volvulus, crises of abdominal pains and periods of obstinate constipation may have been experienced for years before the final acute and fatal attack.

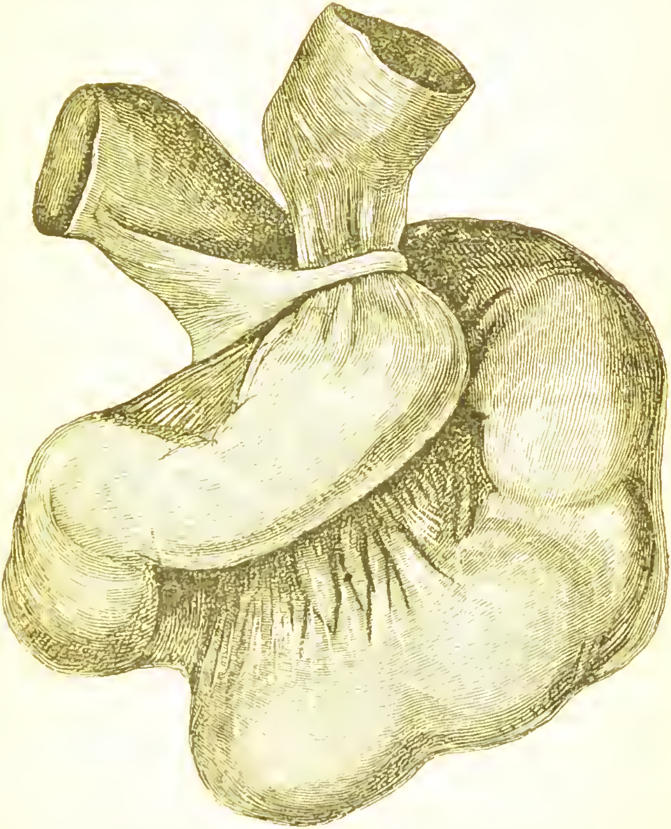

Fig. 17 —Strangulation of Small Intestine by a Band from the Mesentery (From Treves' "Intestinal Obstruction.")

Internal strangulation by bands, diverticula, or other bodies having no structural connection with the circumference of the constricted gut, and invested with a distinct peritoneal covering.

The seat of obstruction is almost invariably the small intestine, and the strangulating cause may be a peritoneal band connected at one end with the mesentery (Fig. 17); a band derived from the omentum; a band connected with the vermiform appendix; a diverticulum from the ileum with an attached band; or possibly the neck of an internal hernia.

Symptoms and diagnosis.—The symptoms of this, as of other forms of intestinal obstruction, vary in many cases, but there are conditions which may concur to indicate pretty certainly the existence of strangulation as the source of trouble, and to exclude other causes. These are as follow: The comparatively early age of the patient; the occurrence of symptoms of obstruction in a previously healthy patient within a definite period of the reception of a blow, or soon after some straining effort on the part of the individual; the severe pain referred to the umbilicus; the early occurrence of collapse; scantiness of the urine; absence of visible peristalsis; the failure to detect a tumour; the non-occurrence of tenesmus or intestinal hæmorrhage; and the absence of the extreme acuteness and rapidity of phenomena which characterise volvulus.

The above symptoms are by no means constantly present in all cases of internal strangulation; in some instances they are altogether absent.

The chance of recovery by medical treatment in a case of internal strangulation, or the possibility of spontaneous reduction, is extremely doubtful.

Treatment of acute intestinal obstruction.—The palliative measures which may be used in the early stage, and when the diagnostic signs as to the cause and localisation of the obstruction are obscure, consist in keeping the patient in the recumbent position; allowing only very small quantities of liquid food; injecting a quarter of a grain of morphine every six hours to relieve pain; applying hot fomentations over the abdomen; and giving occasional doses of hydrocyanic acid with spirits of chloroform, or hydrochlorate of cocaine, if the vomiting is very urgent and distressing.

Purgatives and enemata are worse than useless in these cases. Inversion of the patient has, in a few cases, dislodged the obstruction, and effected a cure.

If after one, two, or three days, according to the severity of the symptoms, the patient has derived no benefit from palliative treatment, the operation of laparotomy, followed by division of the band, or by enterotomy, according to circumstances, should be performed.

Treatment of chronic intestinal obstruction.—Where the calibre of the colon or rectum is gradually reduced by the pressure of some tumour or by cancerous disease of the intestinal walls, the same palliative line of treatment as adopted in cases of acute obstruction may be resorted to. Purgatives should be avoided, but enemata may be tried. When ordinary measures prove unavailing, and the life of the patient is threatened, the operative interference which is under such cases demanded will probably consist in the performance of lumbar colotomy or colectomy. If the obstruction be simply due to impaction of faeces in the rectum, these should, of course, be broken up by manipulation, and then extracted mechanically with a spoon, the patient being meantime under the influence of an anaesthetic.

[For further information the reader is referred to Dr. Fagge's writings, to Mr. Treves' manual on "Intestinal Obstruction," and to Mr. Bryant's Harveian Lectures, 1884.]

VII. HERNIA.

Sir William MacCormac.

By the term hernia is understood the protrusion of a viscus, or a part of a viscus, from the cavity within which it is contained. From common usage, however, the term when taken alone is considered to apply to the viscera of the abdomen, and to be synonymous with the popular term "rupture."

As generally accepted, the term hernia implies that the protruded part is covered by integument, and the expression is not usually applied to the escape of viscera through a recent penetrating wound of the abdomen.

The terms "hernia cerebri" and "hernia testis" are somewhat misleading, and are applied to the escape of disorganised brain matter or testicular tissue through an opening respectively in the skull or in the scrotum.

The essential parts of a hernia may be considered under three heads. 1. The sac. 2. The contents of the sac. 3. The parts that cover the sac.

1. *The sac.*—The sac of a rupture is composed of peritoneum, and forms the sack or bag in which the protruded parts are contained. Hernial sacs are divided into two kinds, the congenital and the acquired. In the former instance the sac depends upon a congenital defect in the peritoneum; it exists as it were ready made: and such sacs are met with only in the inguinal region and at the umbilicus. In the former situation they depend upon an imperfect closure of the tubular process of peritoneum that normally accompanies the testis in its descent into the

scrotum. In the latter locality they depend upon imperfect closure of the ventral walls, and lead to a rare form of rupture known as the congenital umbilical. These congenital varieties of hernia will be dealt with subsequently.

The formation of the acquired hernial sac merits attention. The peritoneum lines evenly the anterior parietes of the abdomen. There are certain weak points in the abdominal wall; as, for example, one such weak point exists in the vicinity of the inguinal canal in the male. Along this canal the testis has passed out of the belly; the spermatic cord occupies its tract, and prevents that tract from being obliterated. Some other organ besides the testis may, if proper force be applied, be made to follow its line of escape, and so constitute a rupture. The peritoneum, moreover, about the inner opening of the inguinal canal, is not so firmly adherent as elsewhere, and under a certain degree of intra-abdominal pressure the little patch of serous membrane that covers the so-called "internal ring" may be made to bulge into the inguinal canal. If that pressure be frequently repeated, the bulging will be increased until a funnel-like depression is seen in the peritoneum at this spot.

By a further step the funnel is elongated into a glove-finger-like bag occupying the inguinal canal; and as soon as the protruded membrane has escaped beyond the narrow limits of the canal into the loose scrotal tissue, it may expand into a bag of pyriform shape, since beyond the canal it meets with less resistance to its progress. To the pyriform bag may be applied the term, a fully developed hernial sac.

The main part of the sac is called the body; the wide extremity the fundus; the narrow extremity (the stalk of the pear) the neck; and the opening of the sac into the abdominal cavity the mouth.

The interior lining of the sac is smooth, but its outer wall is rough; so that when once a sac has been formed it nearly always persists. It contracts adhesions to the parts around and becomes permanent. The contents of the sac may be pushed back into the abdomen, but the sac itself, except under certain conditions, remains permanently irreducible. About the neck of the sac the peritoneum is thrown into pleats or folds. In time these pleats become matted together, and then the neck becomes a tough and permanent structure; so that if all other parts outside the sac were to be cut away, that structure would still retain its peculiar outline. Before such matting together takes place, the neck of the sac has no independent existence, but is due to the narrowness of the passage it occupies; and when the parts around it are cut away it ceases to exist. Thus it happens that the contents of a sac cannot be strangulated or nipped by its neck until that neck has taken the permanent form (by agglutination of the pleated peritoneum) of a definite and rigid ring. In process of time the neck tends to become very dense and firm.

The neck always occupies the narrowest part of the tract along which the protrusion has passed.

The body of the sac may undergo little change, or it may become much thickened, or may send off a diverticulum or secondary sac. In a hernia of the cæcum or of the bladder there is usually either no sae at all, or only a partial one.

2. *The contents of the sac* vary mainly according to the position of the hernia. Usually the small intestine (and especially the ileum) is the part involved in the rupture.

All the abdominal viscera, however, with the sole exception of the pancreas, have been, as recorded cases show, the subjects of protrusion. Next in frequency to the small intestine comes the colon, and after the colon the stomach. The great omentum is very frequently involved in a rupture, especially in those occupying the left side of the body, the epiploon being placed more to the left than to the right of the middle line.

A rupture containing intestine only is called an *enterocele;* one containing omentum only an *epiplocele.* To the hernia occupied by both omentum and gut, the term *entero-epiplocele* is applied.

By the term *cystocele* is understood a rupture containing a part of the urinary bladder.

3. *The parts that cover the sac* will obviously vary according to the situation of the hernia, and will be considered when dealing with the special forms of rupture. In general terms, it may be said that the layers of fascia covering the protrusion become fused together, that muscular tissues waste, that the subcutaneous fat is apt to disappear, and that the skin shows a tendency to atrophy. Such changes are best seen where there is no redundant skin to accommodate the protrusion as in femoral hernia, and are usually absent when the opposite condition exists, as in the case of small scrotal herniæ.

Etiology of hernia.—1. *Sex.* Hernia is more common in males than in females in the proportion of two to one for all ages and for varieties of rupture (Kingdon).

2. *Age.*—It is met with at all periods of life, but the majority of cases are developed before the age of thirty-five years. In many instances the rupture is congenital.

3. *Heredity.*—A disposition to hernia may be inherited. Mr. Kingdon has estimated that thirty-four per cent. of all cases show the effects of hereditary influence. The great majority of these cases are met with in infants who are the subjects of congenital inguinal hernia.

4. All forms of congenital hernia depend upon certain definite *structural defects.*

5. *Long mesentery.*—It has been suggested also that an abnormally long mesentery may dispose to hernia, and may be a congenital condition. Mr. Treves has shown* that in a normal subject no loop of small gut can be drawn out of the abdomen below the level of the pubic spine, and that therefore when intestine occupies the scrotum it must present a much lengthened mesentery.

6. *Occupation* influences the production of hernia, rupture being most common among the labouring classes. It would appear to be encouraged by muscular exertion undertaken when the thighs are bent at the hip, as in lifting weights. In this position the structures about the inguinal and femoral "orifices" are relaxed, and a vigorous contraction of the abdominal muscles must bring much pressure to bear upon those points. Many times a hernia has become protruded while straining at stool, the structures about the groin being relaxed by the posture assumed. Severe, abrupt, and intermittent exertion especially dispose to hernia.

7. *Certain diseased conditions* encourage rupture. Thus hernia is apt to occur after a weakening of any part of the abdominal wall by wound, rupture of muscle, or abscess. It is encouraged by the relaxed parietes left after parturition, or ascites or abdominal tumour, and is not infrequent in those who have lost their muscular tone, and exhibit a relaxed condition of their tissues. A rapid loss of fat in the subjects of great obesity would appear to favour certain herniæ. Diseases involving frequent vigorous use of the abdominal muscles, as chronic bronchitis, straining at stool, straining to empty the bladder, etc., encourage the production of rupture.

* Hunterian Lectures, 1885.

Seat of hernia.—The various special or local forms of hernia will be dealt with subsequently. It may here be said that out of every 100 cases of rupture, 84 will be inguinal, 10 femoral, and 5 umbilical.

The clinical forms of hernia.—From a clinical point of view hernia may be considered under the five following heads: 1. Reducible. 2. Irreducible. 3. Obstructed or incarcerated. 4. Inflamed. 5. Strangulated.

1. Reducible hernia. Diagnosis.—In this, the most common form, and the form in which most recent ruptures are met with, the contents can without difficulty be reduced into the abdomen. The patient presents, at one of the sites for hernia, an elongated or rounded tumour, broader below than above, and often narrowed into a species of neck near its point of connection with the abdominal parietes. It is smooth and regular. When the contents of the sac are intestine the swelling feels elastic. It becomes tense and enlarged when the patient strains or exerts himself. It is probably larger when he is standing up than when he is lying down. It presents a distinct impulse on coughing. It is tympanitic on percussion. If reduced it returns into the abdomen with a slip and with a peculiar gurgling noise.

When the sac contains omentum alone the tumour is compressible, and often feels flabby and uneven. It is dull on percussion. It is less readily affected by position and straining. It presents a fainter impulse on coughing. If reduced it returns gradually and without gurgle. In entero-epiploceles the signs of the two forms of hernia may be combined, but except in very simple and typical cases the diagnosis of the contents of the sac is by no means certain.

The subjects of reducible hernia usually complain of a distressing sense of weakness about the regions of the tumour, and of pain there during exertion. At the same time they are apt to be troubled with some discomforts within the abdomen, and to be the subjects of an uncertain kind of dyspepsia.

The prognosis in reducible hernia is favourable so long as the rupture is of moderate size, can be kept well reduced by a proper truss, and the patient is not exposed to violent exertion.

The treatment may be considered under two heads: A. Palliative measures. B. The so-called radical cure.

A. **Palliative measures.**—These consist simply in the use of a proper truss whereby the hernia is retained within the abdomen. If the rupture be a small enterocele, it may be prevented from descending for months or years by means of a truss. The larger the tumour, the more difficult is it to prevent the intestine from descending, and the greatest difficulty is experienced when the orifice of the hernial sac is disproportionately large. Obesity offers as a rule a serious obstacle to the proper adjustment of a truss. A small inguinal hernia is more easily kept up than is a femoral rupture of corresponding size. The least amount of difficulty is experienced in retaining ventral and umbilical ruptures when they do not exceed moderate dimensions. If some irreducible omentum be left in the sac, it seriously interferes with the efficacy of a truss, and under such circumstances much difficulty may be experienced in preventing the descent of a knuckle of reducible intestine. Other things being equal, congenital inguinal herniæ are more easily retained than are acquired inguinal ruptures of similar proportions.

In many instances, both in young subjects and in adults, the use of a truss has led to a permanent cure of the slighter degrees of hernia, especially in instances where improvement has taken place in the state of the muscular system. The continuous and careful use of a truss has led to cure in cases of congenital inguinal hernia, the patent tube of peritoneum having been induced to close under the long maintained compression.

Trusses.—The essential parts of a truss are the pad, which is placed over the hernial orifice, and the spring or belt which keeps the pad in position. A good truss should be light, firm, and elastic, and should keep up the rupture in all positions of the body and under all ordinary circumstances of exertion. If a truss be too slight, or if it be ill fitting, it will permit the hernia to come down behind it. If, on the other hand, the pad press too firmly, it may produce atrophy of the parietes, and even enlargement of the hernial opening, or may cause any irreducible contents to inflame. In all cases the truss should be worn all day. At night the truss used may be replaced by a lighter instrument. The patient should also be provided with a "bathing truss," *i.e.* a truss so made as to be unaffected by immersion in water.

The pad is made of various materials. It must vary in size according to the dimensions of the hernial aperture, and should overlap the aperture for at least half an inch all round. A still greater margin should be allowed in large herniæ. With regard to the precise direction of the pad, in any case the rule must be observed that the pressure be exerted in a direction at right angles to the plane of the hernial passage. Thus, in a thin subject, with inguinal hernia, the pad should press directly backwards, while in patients with pendulous abdomens the line of pressure would be upwards and backwards, or upwards, backwards, and inwards. Too convex a pad is objectionable, since it tends to enlarge the aperture instead of merely protecting it.

The spring of the truss is represented by two extremes in the French and German models. "The former resembles the coil of a watch spring, and is very elastic and clinging; the latter exactly fits the outline of the body in its state of repose. It is almost inelastic and very hard. The French instrument is always pressing inwards, even when the wearer is at rest. The German scarcely presses at all when the abdomen is soft, but resists with power when any expulsive force makes the abdomen swell" (Birkett).

The ordinary *English truss* presents a spring of an intermediate character. The pad is affixed to one end of the spring at an angle that varies with the nature of the rupture. On the pad are two studs: the upper to take the strap that passes from the free end of the spring; the lower to take a strap that passes along the perinæum between the thighs. The spring must pass round the body just below the iliac crest. If it is above the crest, it will be displaced by the action of the abdominal muscles; if it is much below the crest, it comes under the influence of the gluteal muscles; and if it be on the crest, it is apt to chafe the skin.

To measure for an inguinal or femoral truss the tape should be made to start from the lower part of the hernial orifice, pass up to the anterior superior spine of the same side, then round the body one inch below the iliac crest, to the other anterior spine, and thence to the upper part of the hernial orifice.

In oblique inguinal hernia the pad should be placed over the internal ring and canal, in direct inguinal over the external ring. In femoral rupture the pad should press as directly as possible upon the femoral ring at the level of Gimbernat's ligament.

To test the value of a truss the patient should strain and cough in such positions as will most relax the parietes about the hernial orifice, and encourage any tendency of the truss to shift its position. Thus, in the case of herniæ about the groin he should be made to strain while sitting with the body flexed at the hip joints, and with the legs wide apart, so as to prevent the abdominal walls from deriving support from contact with the thighs.

Some of the chief trusses may be briefly named.

Eggs' truss is entirely rigid, requires to be accurately fitted, and is made upon the German model.

Coles' truss is very light, has a spinal spring in the pad, and requires no thigh strap. It does admirably for slight herniæ for infants, and for patients not subject to violent exertion.

In *Salmon and Ody's truss* the spring is self-retaining. At one end is a large padded plate, which takes its hold from the centre of the back, while at the other end is the hernial pad, which is attached to the spring by a movable point.

In the *moc-main lever truss* the spring is in the pad itself, and the pad is compressed against the seat of the hernia by means of a strap that encircles the body. It is only of use when a slight degree of support is required, and it may be conveniently worn by patients with a suspicion of commencing hernia. It also answers well in the small ruptures of the aged or decrepid.

In the admirable trusses devised by *Mr. Wood* the pads are solid, and are held in position by a spring that encircles the body. For oblique inguinal hernia the pad is of horse-shoe shape. The two bars of the horse-shoe come over the pillars of the ring, while the toe of the shoe presses against the internal ring. The cord is thus saved from pressure, and the patient is in reality provided with a new rigid external ring. For direct hernia the pad is in the form of an oval ring; and for femoral herniæ the pad is egg-shaped.

For irreducible femoral herniæ a truss with a hollowed pad is used, so as to support and protect the parts. A like pad may be used for small irreducible inguinal ruptures.

For large irreducible scrotal herniæ a "bag truss" is used, the apparatus being merely a well-adjusted "suspensory bandage."

B. **Methods for radical cure.**—(*a*) *Wutzer's operation.* This procedure has been applied to reducible inguinal herniæ, and consists in invaginating a part of the scrotum, and with it the fundus of the sac, into the inguinal canal, and in fixing it there by exciting adhesive inflammation in the neck of the sac. The scrotal tissues are invaginated by means of a hollow boxwood cylinder, the end of which is passed up as far as the internal ring. This cylinder conceals a needle, which is made to traverse the invaginated scrotum, the sac, and the anterior abdominal wall. The needle and the cylinder are then fixed in place by means of a concave boxwood case, which is screwed to the cylinder. The apparatus is retained for six to eight days, when adhesion will have occurred at the fundus of the invaginated portion. The operation has been modified in many ways; but it is now practically abandoned, as the cures obtained have not been permanent, and a truss cannot be dispensed with.

(*b*) *Wood's operations.*—These procedures, known as the subcutaneous wire operations, are varied, according to the nature of the herniæ dealt with. Space will not permit of a detailed account of these operations. They are ingenious and exceedingly elaborate, and as in procedures of this character everything depends upon detail, the reader is referred to Mr. Wood's own account of the measures. An excellent account is given in vol. v. of Ashhurst's "Encyclopædia of Surgery."

The general principle of these operations (which have been applied to inguinal, femoral, and umbilical ruptures) may be illustrated by a reference to the procedure in the first-named hernia. In this form, the hernia having been reduced, an incision is made into the scrotum, the fundus of the sac is invaginated upon itself, and pushed up into the inguinal canal. It is now secured in this position by a wire suture. The wire suture, however, in addition to securing the sac, is so passed from one side to the other of the canal that it is made to practically close the inguinal canal. The wire suture, secured over a pad, is retained from eight to twelve days, and excites a varying degree of plastic inflammation about the parts. "The effect of this operation," writes Mr. Wood, "is to unite in one cicatrix the sides of the inguinal canal as far up as the deep ring, together with the pillars of the superficial ring; this union supports the invaginated, twisted, and obliterated sac, with its intimate coverings of external and internal spermatic and cremasteric fasciæ. All these are blended together in the fibrinous effusion consequent upon the pressure of the wires." With regard to the results of these operations, Mr. Wood states that the risks amount to only one per cent. In favourable cases he estimates the successes at seventy-five to eighty per cent., and in less favourable cases at sixty per cent. Many of the patients have never required to wear a truss again; others have been able to wear a lighter truss; and even in the unsuccessful cases, Mr. Wood states that the patient has never been rendered worse by the operation.

(c) *The treatment by injection.*—By this procedure an irritating fluid is introduced into the tissues about the neck of the sac. Some inflammatory action results, and by a species of cicatrisation the neck of the sac is closed. The operation was first introduced in America by Dr. Heaton, who used, as his injection material, an extract of oak bark. Dr. Warren, of Boston, has perfected Dr. Heaton's method, which he has extensively adopted with, he states, very excellent results. This method of treating reducible herniæ has lately been again advocated by Dr. Schwalbe,* whose plan is as follows: The rupture is reduced and retained by the fore-finger. A Pravaz's syringe is then thrust through the skin at a point from one to two cm. from the neck of the hernia, and is then cautiously pushed deeper until its point reaches the vicinity of the hernial orifice. This must be done, however, without wounding the sac. When the canula is in this position the contents of the syringe are slowly injected into the tissues about the hernial aperture. The material employed is a twenty, fifty, or seventy per cent. solution of alcohol. The pain caused by the operation is dulled by slight chloroform narcosis, or by local anæsthesia. The injection has to be repeated, on an average, twenty times in each case, and confinement in bed for the first few weeks of cure is essential. The cure of an umbilical hernia will probably require two to three months; a femoral hernia three to six months; while an inguinal hernia may require treatment for one year before it is wholly cured. Dr. Schwalbe has operated upon fifty-one patients without any evil result following. Of the number and permanency of the cures, however, more information is at present needed. These operations have met with little or no support in this country. The results appear to be uncertain; the treatment is painful, very tedious and protracted, and in unskilled hands there must be a risk of piercing the sac and injecting the irritant into the peritoneal cavity.

(*d*) *Spanton's operation.* — This procedure can only be applied to such herniæ as are quite reducible. A vertical incision is made into the scrotum over the fundus of an inguinal hernia. The subcutaneous structures are separated from the sac and its fascial coverings. The gut is reduced, and the sac is then invaginated with the finger until the fundus occupies the internal ring. A screw instrument, like a cork-screw, with a flat instead of a rounded thread, and in reality a spiral needle, is next applied. The screw is wound into the soft part from above downwards, in such a way that it is made to bring together the margins of the inguinal canal, and to transfix and hold in position the invaginated sac. The point of the screw is ultimately brought out at the scrotal incision. An antiseptic dressing can be applied, or the part simply protected by iodoform gauze. The instrument is retained *in situ* for about a week. At the end of that time it will have excited much inflammatory action along its track, with the result that the sac is obliterated, and the canal plugged with cicatricial tissue. The operation appears to be free from risk, and, in Mr. Spanton's hands, has been attended by a very considerable degree of success.

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* "Die Radikale Heilung der Unterleibsbruche." Berlin, 1884.

A detailed account of the operation will be found in the *British Medical Journal* for December, 1880.

(*e*) *Obliteration of the sac.*—This operation may be described as it is applied to a scrotal hernia. An incision is made along the centre of the tumour in its long axis, and is so planned that the centre of the incision corresponds to the external ring. The sac is exposed, and is entirely separated from the surrounding parts. The contents are reduced, and the neck of the sac having been defined, that part is surrounded by a ligature of catgut or Chinese twist. This is very tightly tied, cut short, and left. The sac below the ligature is then excised. One or two sutures of catgut, wire, or Chinese twist are next introduced so as to close the external abdominal ring; these are cut short and are permanently retained, a drain is introduced, and the wound closed. The whole proceeding should be conducted under Listerian precautions. If the hernia be very large, an elliptical piece of skin may be removed before the wound is closed. If the hernia be in whole or in part not reducible, the sac must be opened, adhesions divided, and portions of adherent omentum ligatured and removed.

Some surgeons ligature the neck alone, and leave the sac undisturbed. By this means the extensive raw surface that results from the excision of the sac is avoided, and it is maintained that the shrunken sac acts as an efficient plug. In such a case, however, the sac may suppurate, and trouble therefrom may arise.

Mr. Charles Ball dissects the sac from its attachments, grasps the neck high up with a pair of clamp forceps, and then twists it, executing, as a rule, three complete revolutions. He claims three advantages for this measure. 1. The sac is closed at a higher point in the inguinal canal than could be reached by any ligature. 2. The peritoneum about the abdominal orifice is disturbed, is tightened, and thrown into folds, which probably in time adhere. 3. The sac is well and completely closed.

With regard to the cases in which this operation should be employed, it may be said that it should not be adopted in small or moderate herniæ that can be easily kept up by a truss. It may be adopted (1) in herniæ of large size that cannot be supported by any kind of appliance; (2) in herniæ formed in whole or in part of adherent omentum, as in ruptures where a piece of adherent omentum occupies the sac, and prevents the proper retention of reducible bowel; (3) in strangulated herniæ.

The procedure when applied to umbilical or ventral ruptures differs in no essential respect from the operation already described. In femoral hernia a great difficulty attends the closure of the hernial orifice. A needle can be well passed through Gimbernat's ligament, but on the other side of the ring there is hardly enough tissue to the inner side of the femoral vein to hold a tight suture. In these ruptures the process of torsion of the sac would appear to be indicated.

This operation cannot be strictly called a radical cure. In many instances it has led to a complete cure of the hernia. The best that can be said of it is this, that it will render almost any hernia tolerable and capable of being comfortably supported by a slight truss. It has also very special advantages in connection with the treatment of strangulated herniæ. Leivrink, in 188 examples of the operation performed in cases of strangulated rupture, found the mortality to be 17 per cent., with some recurrence of the hernia in one-third of the cases. Nussbaum places the recurrences at one half.

In small inguinal herniæ and in ordinary femoral herniæ the whole sac may with advantage be removed; but in large inguinal herniæ, and especially in those of the congenital form, the total extirpation of the sac is unnecessary, and it may prove difficult to dissect it away without injuring some of the constituents of the spermatic cord, and thus give rise to considerable hæmorrhage, difficult to check at the time, and prone to recurrence. It is sufficient in such cases to dissect a ring-like portion of serous membrane away from the neck of the sac. This leaves a broad, raw surface, which afterwards firmly unites in a cicatricial mass, leaving the testicle shut off below in normal and practically undisturbed connections.

It is desirable to suture or ligature the neck as high up as possible, so as to leave no pouch of serous membrane in which a hernia may again form. In the majority of cases this is the plan of treatment

I have adopted. In some only were the pillars of the ring sutured in addition. I have not been able to observe that the final result was much affected by suturing the pillars of the ring, and the operation is simplified by the omission of this step. Suturing may, however, be of immediate advantage in cases complicated by cough, and it probably increases the amount of plastic material thrown out, and consequently the strength of the subsequent cicatrix. As a rule, if the ring be wide it is better to close it in this way.

One important practical effect must follow on this innovation in the treatment of hernia, namely, that early operation, so important in all cases of strangulation, will tend to become yet more early, since I regard it as justifiable to operate for the radical cure of hernia by this method in the absence of symptoms of strangulation.

In nearly all cases of strangulated hernia, after the division of the stricture, a partial or complete abscission of the sac should prove an ordinary part of the operation. Where the aperture is large, its margins should be drawn together, as before stated, by suture. Chromicised or green catgut admirably suffices for the purpose; but, if preferred, a silver suture may be used. In many cases the operation may be extraperitoneal from the beginning, and the ligature applied around the neck of the sac before it is opened or removed. To this detail, however, I do not attach importance, as it possesses little advantage if antiseptic precautions be strictly observed. The proceeding, in fact, is sometimes disadvantageous by preventing drainage, and also because of the frequent presence of adhesions within the sac.

In non-strangulated herniæ the operation may be performed without serious risk, if the patient be in good general health, and with the result, probably, of permanently freeing the individual from the consequences of a debilitating infirmity.

In young children up to the age of eight or nine I should not advise operation; first, because of the great difficulty of maintaining the wound aseptic; and, in the second place, because the effort to procure a permanent cure by a carefully adjusted truss is so often successful.

2. **Irreducible hernia.**—In this form of rupture the contents cannot be returned into the abdomen; but the tumour presents an impulse on coughing, and exhibits the ordinary physical signs of hernia.

Such herniæ are usually of old standing, and are often of large size. As a rule, herniæ of the cæcum or of the bladder are irreducible. The principal causes of irreducibility are the following: (1) The great bulk of the tumour, as seen in very large, pendulous, scrotal, and umbilical herniæ. (2) Adhesions between the sac and its contents, matting together the loops of protruded bowel, or between one part of the sac and another, and so forming bars which impede reduction. (3) A great development of fat in prolapsed omentum may lead to a reducible rupture becoming permanently irreducible. In many instances some part of the hernial contents are reducible, while the remaining portion is fixed in the sac. The commonest examples of this kind of rupture are afforded by large scrotal herniæ, and by femoral epiploceles.

An irreducible hernia often causes considerable trouble. It produces a sense of weakness in the part, and is attended by more or less abdominal pain by intestinal irregularities, and by dyspepsia. It is apt also to increase in size, and is always liable to become obstructed, inflamed, or strangulated. It is peculiarly exposed to injury.

Treatment.—If large the hernia should be supported by a bag truss. If small it must be protected and supported by a truss with a hollow pad. The patient should avoid exertion, adopt a simple diet, and take care that the bowels act regularly. In instances where the irreducibility has depended upon a development of fat in the hernial contents, the rupture has been rendered reducible by keeping the patient in bed for several weeks, with an ice bag applied to the tumour, and upon a very low diet.

In the majority of instances, however, a more or less complete cure of the hernia could be effected by opening up the sac, dividing such adhesions as require division, then reducing the contents, and treating the sac and the hernial orifice in the manner described in the "radical cure" (page 234).

This procedure in large scrotal herniæ affords great relief, and enables the patient to retain the rupture comfortably with a light truss. In cases where very extensive adhesions involve the bowel, active interference will in most cases be counter-indicated.

Cæcal herniæ and cystocele may be considered here, since they are most usually irreducible.

Cæcal herniæ are met with only on the right side (inguinal) and at the umbilicus in certain forms of congenital hernia, attended by malformation of the colon. In the former situation there will be either no sac, or in most instances but a partial one. A large irregular tumour is produced, which is more or less irreducible, which has no great disposition to become strangulated, but is very apt to present the phenomena of an "obstructed hernia." When the cæcum takes part in a congenital umbilical hernia, it is provided with a perfect sac, and may be easily reduced.

Cystocele is very rare. The sac is partial and the rupture irreducible. The protrusion is attended by difficulty in urinating and pelvic pain. The tumour varies in size, and by squeezing it when full urine may be forced along the urethra. It is dull on percussion, and presents distinct evidence of fluctuation. A cystocele may be combined with some protrusion of intestine.

3. **Obstructed or incarcerated hernia.**—In this form, the bowel occupying the tumour becomes obstructed by fæcal matter, and probably by portions of undigested food. As a result, symptoms of intestinal obstruction are produced. The condition is usually met with in herniæ containing colon, and particularly in such as are in whole or in part irreducible. It is most common in umbilical ruptures and in individuals who are liable to constipation. When obstruction takes place in a hernia, the tumour is found to be larger than usual, a little painful, and possibly tender. It is dull on percussion, feels doughy to the touch, can often be lessened in size by pressure, is irreducible, but presents an impulse on coughing. It will be attended with some colicky pains, with a dragging sensation about the umbilicus, with defective appetite and coated tongue. There will be some flatulent distension of the abdomen, nausea that may pass on to vomiting, and more or less constipation. Unlike a strangulated hernia, there are no evidences of constitutional depression; the vomiting is trifling, the constipation not complete, and the tumour neither so tense nor so painful as in strangulation. As already observed, an impulse on coughing is retained.

Treatment.—Rest in bed with the body so placed as to relax the fascial structures about the hernia. An ice bag should be applied, and if much colic exists, a little opium may be given. Nothing but iced water should be given by the mouth. In twenty-four hours the more marked symptoms will probably have passed off, when an enema may be administered, followed in a few hours by a dose of castor oil. The less the tumour is manipulated the better.

4. **Inflamed hernia.**—This condition is usually the result of some injury inflicted upon a small irreducible rupture; and is often due to a badly fitting truss. It is most frequently met with in connection with small irreducible femoral epiploceles. It is essentially a form of well-localised peritonitis, involving the sac and its contents.

The symptoms are as follows: The tumour becomes hot, tender, and painful. If purely omental it is apt to feel hard and nodulated; if an enterocele, much fluid usually collects in the sac. The swelling is irreducible, but retains an impulse on coughing. There will be some fever, vomiting, and possibly constipation. The vomiting will be, however, slight, inconstant, and the ejected matters will be composed only of the contents of the stomach. The constipation, likewise, is not invariable, is not complete, and flatus is usually freely passed. It differs from strangulated hernia, mainly in the circumstance that there is little or no constitutional disturbance, while the chief symptoms are purely local. It is, on the other hand, not infrequent to meet with patients suffering from a severely strangulated hernia who are not even aware that they are ruptured.

The treatment consists in absolute rest in bed, with the knees bent over a pillow, a low diet, and the application to the part of an ice bag. An enema may be given, and when the inflammatory symptoms have subsided, a mild aperient, such as castor oil, should be administered. If there be much pain, opium may be used. In certain cases the inflammation may pass on to suppuration of the sac, and the treatment of such a complication resolves itself simply into the ordinary treatment of an abscess.

5. **Strangulated hernia.**—This term is applied to a rupture in which there is (1) an obstruction to the passage of the gut back into the abdomen;

(2) an obstruction to the passage of the intestinal contents in the gut involved; and (3) an obstruction to the passage of blood in the herniated tissue.

The condition is met with in all forms of hernia, and may occur in any case. It is more common in old than in recent ruptures, is more often met with in women than in men, and in active adult life than in the very young or the very old. It is more often met with in inguinal than in femoral ruptures (Bryant), and is by comparison uncommon in the umbilical form. In inguinal herniæ it more often involves the congenital than the acquired forms, other things being equal.

Mechanism of strangulation.—Strangulation is usually due to a sudden descent into the sac of more than its usual amount of contents. This is often brought about by some abrupt unwonted exertion. There is evidence to show, however, that increased peristaltic movement in the bowel may lead to the conditions involved in strangulation. Strangulation is often preceded by some "bowel complaint," or intestinal disturbance of some kind. In other instances the swelling of the contents of the sac plays a primary part in producing the strangulation. The gut has become engorged by the nature of its contents, or by the alteration in the circulation produced by some enteritis. It has swollen slowly until at last the swelling has reached a degree that enables the phenomena of strangulation to be produced. There are thus instances where the peculiar symptoms have developed during sleep, or while the body was at rest. In any case the hernial contents are increased in volume. The narrow strait through which those contents have passed is occupied to the utmost. The veins are compressed, and the parts rendered still more swollen, and when these circulatory changes are produced, the phenomena of strangulation are not far distant. The constriction may be at the neck of the sac produced either by the structures immediately outside, or by the tissues of the neck itself; it may be at some narrowed point in the body of the sac as seen in "hour-glass hernia;" it may be caused by adhesions within the sac, between which bowel or omentum has been thrust. In the majority of instances the constricting agent is the ring of tissue outside the neck of the sac. There is no evidence to show that strangulation can be produced by spasmodic contraction of the tissues outside the neck of the sac. These tissues are usually hard and dense, and play a passive and not an active part in the condition induced.

The strangulated parts will not return into the abdomen, because the mechanical relation between the size and shape of those parts, and the size and shape of the hernial ring, will not permit them to alter their position. The mechanical obstacle to reduction is akin to the mechanical obstacle that prevents a button from being drawn through a button-hole by mere traction. It will be seen from this that enteroceles are very much more liable to strangulation than epiploceles, and also that an irreducible hernia may be the seat of strangulation either on account, as is most usual, of the descent of more gut, or on account of a swelling of the parts already in the sac.

Local effects of strangulation.—The loop of gut involved becomes swollen and its walls thickened. At the seat of constriction a deep furrow is formed in the intestine. It must be remembered that in the great majority of cases a knuckle or loop of gut is implicated, and consequently two tubes of intestine fall within the constricting line. Since the gut above the constriction will be distended by its retarded contents, and will subsequently become hyperæmic, and since the gut below the stricture will be empty and collapsed, it usually happens that the upper limb of the knuckle in question will show more conspicuous changes at the line of constriction than will the lower limb. As a result, it follows that when the strangulated gut gives way at the stricture line as a result of long-continued imprisonment, it is usually the upper portion of the loop, *i.e.* the part nearer to the pylorus, that exhibits the breach. The loop in the sac soon becomes of a deep red colour from interference with the venous circulation, becomes œdematous, and often exhibits patches of extravasated blood. In time the tint deepens into a claret, and then into a purplish-brown colour. As time goes on all circulation is arrested, and the bowel becomes almost black, or greenish-black, or a blackish chocolate-brown, and shows the aspect of gangrene. The changes are not as a rule such as involve any question of inflammation. Inflammatory phenomena demand a condition of the vessels other than that of complete arrest of the circulation. It is common, however, to find slight evidences of inflammation in the less acute cases or at the outset of the strangulation, and then flakes of lymph may be found upon the surface of the strangled loop. At first the bowel is smooth, glistening, and perfectly tense and elastic. As changes progress these features are lost. It becomes dull, and its surface is a little harsh or even sticky from death of the peritoneal epithelium. It subsequently loses its elasticity and yields under the finger. Death of the gut is not to be solely judged by an appeal to its colour. The more important test is the state of the peritoneum that covers it, and the condition of its elasticity. The serous coat, being farther from the blood-vessels than the muscular coat, is usually the first of the two to perish.

If the involved loop be opened, it will be found to be occupied by bloody mucus or by much dark blood, The mucous membrane soon perishes, and is sometimes found shed in large part. With regard to the sac itself, it commonly exhibits the phenomena of peritonitis; and when much lymph is found in the sac cavity, it is usually produced by the inflammation of that membrane.

An accumulation of fluid within the sac is the product of the peritonitis that is present. At first this is clear and serous. It soon, however, becomes blood-stained, although still clear. As time advances this bloody fluid becomes turbid, and may assume a browner tint. If the gut be gangrenous, it will probably be quite turbid or opaque, and present a fæculent odour.

The changes in strangulated omentum are identical with those met with in the bowel if allowance be made for the differences in structure.

The gut, when gangrenous, may become ruptured, often from unnecessarily severe taxis, and fæcal matter may be found in the sac. Sometimes there is merely a small perforation at the fundus of the loop, or in other instances the loop has not given way, but fæcal extravasation is found to have occurred at the line of stricture, usually from the upper limb of the involved loop. Gangrene of the intestine is more common, other things being equal, in femoral than in inguinal hernia. As a rule when the gut gives way in strangulated hernia, no fæcal extravasation takes place into the abdominal cavity. It is found in such cases that adhesions have formed about the hernial orifice, so that the ruptured bowel is held in place, and all communication between the sac and the peritoneal cavity is shut off. In neglected strangulated herniæ, the sac, or rather the tissues immediately outside it, may suppurate, and an abscess may form. When such an abscess is opened, it is not uncommon to find that the sac has sloughed *en masse.* If the patient recover, a fæcal fistula results.

Symptoms.—The symptoms usually commence with pain at the seat of the hernia. The rupture, if it has been previously noticed, will be found to be increased in size, and to have become more tense, to be duller on percussion, to be tender, especially near the neck, and to have lost all impulse on coughing. It will of course be irreducible. If much serum collects in the sac the tumour may undergo increase in size after the occurrence of the strangulation. The patient will be attacked with some colicky pain in the abdomen, and a sense of constriction and pain in the epigastrium; he will probably feel faint, and will be seized with vomiting. The last-named symptom is one of the earliest to appear, and one of the most constant and pronounced. The vomited matter consists at first of the contents of the stomach, then of bilious matters of a greenish colour. In time the ejected material becomes brown, and presents at first an intestinal and subsequently a fæculent odour. The vomiting is very frequent, persistent, and distressing. It occurs after the swallowing of any food as well as at other times.

There is absolute constipation, not even flatus being passed. At the commencement of the attack, however, the bowel below the obstruction may empty itself, and there may even be a little quasi diarrhœa with tenesmus. The abdominal pain increases; it is of a colicky character, is paroxysmal, is a little relieved by the vomiting, and is most severe about the umbilicus. There is often a fixed pain about the neck of the sac. If relief be not given, the patient loses strength rapidly, the eyes become sunken, the nose pinched, the skin cold and clammy, and in severe cases the symptoms of collapse are marked. The pulse is small, rapid, and compressible. The tongue is at first covered with a creamy fur, but it soon becomes dry and brown; great thirst is complained of. The urine is much diminished in amount, and is of high specific gravity. The chlorides are conspicuously diminished in amount, and if the strangulation has existed for some time, albuminuria is present (Englisch). If the strangulation be unrelieved, the symptoms progress, and the patient dies usually in a state of collapse. In very acute cases death from collapse may supervene before any very gross local changes have taken place. In the majority of cases death follows upon the gangrene of the gut, or upon peritonitis or upon yielding of the bowel at the stricture line. When gangrene sets in the pain diminishes or ceases, the vomiting is usually replaced by hiccough, the pulse becomes feeble and intermittent, the symptoms of collapse become pronounced, and a low form of delirium is not uncommon. In such a case, also, there may be local evidences of inflammation of the hernial sac.

Modification of the symptoms.—(1) In small herniæ, especially those in the femoral region, the local symptoms may be so little marked that the patient may fail to draw the surgeon's attention to the rupture, or may even be unaware that he is ruptured. If there be much omentum in the sac the tumour may still feel soft and lax after strangulation. If a small knuckle of gut in a large rupture be strangulated by adhesions within the sac, the tumour may still present an impulse on coughing after strangulation.

(2) The vomiting may in rare cases be slight, or may cease after awhile, or be persistent but not fæculent at any time.

(3) It must be remembered that the principal symptoms can be masked by opium. With the use of the drug the pain disappears, the pulse improves, the signs of collapse are less marked, the amount of urine is increased, and the vomiting rendered much less frequent. It is unwise, therefore, to administer

opium until the diagnosis is clear and a plan of treatment has been determined upon.

Strangulated omental hernia.—This form of rupture is denied by some, and there is little doubt that in many cases of supposed strangulated omental hernia, a minute knuckle of gut has been involved, but has escaped notice on an operation being performed.

A strangulated omental hernia is attended by symptoms of the same general character as those first described. The symptoms are, however, as a rule, less severe. The pain is slighter, the vomiting less severe, and the constipation often incomplete. The constitutional depression is less marked, and, in fact, the symptoms are the same in kind as those of strangulated enterocele, but differ in degree. The hernial tumour feels nodular and hard. The case, if left to itself, will probably end in a fatal peritonitis, and such cases require as active treatment as do the more common forms of strangulation.

Littré's hernia.—In this form of rupture an entire knuckle of intestine is not implicated, but a portion only of the circumference of the bowel is involved in the hernial ring. The part of the bowel constricted is firmly held by the constricting agent, and although this part becomes strangulated, and will if unrelieved become gangrenous, the lumen of the intestine is not entirely occluded. (*See* Fig. 18.) This form of strangulated hernia is practically limited to the femoral region. The tumour is often so small as to be overlooked, and the condition is usually observed in small reducible herniæ, for which no truss has been considered necessary. The symptoms are less acute than those attending the ordinary strangulated rupture. The

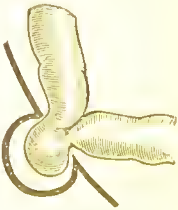


Fig. 18.—Littré's Hernia.

pain is severe, and vomiting appears early, but the vomiting is not so urgent, nor are the ejected matters so apt to become fæculent as is the case in the common form. There may be constipation, but usually this is incomplete, and loose motions may be passed throughout the progress of the case.

The ensnared part is apt to become rapidly gangrenous, and it follows therefore that a Littré's hernia calls for prompt surgical interference.

The diagnosis of strangulated hernia presents in the majority of instances no especial difficulty. The general symptoms to which most importance attaches are the severe and persisting vomiting, the absolute constipation, and the marked constitutional depression. Of the local symptoms, the most important perhaps is the absence of impulse on coughing in the tumour. In obstructed or incarcerated hernia the most conspicuous symptoms are those of obstinate constipation. In inflamed hernia the local manifestations predominate over all others. In strangulated ruptures the constitutional symptoms are the most striking.

The prognosis is bad, and it may be said that unless relieved nearly all cases will end fatally. Instances have been recorded where patients have declined all interference, where the gut has become gangrenous and the sac has sloughed, where the skin has in time given way and an artificial anus has developed, and yet the patient, after exhibiting the very gravest symptoms, has recovered. Such instances are rare and exceptional, and can take no part in determining the course of treatment to be pursued. In very acute cases, especially when the treatment has been ill advised (as, for example, when purgatives have been given), death may follow in forty-eight hours if the hernia be not reduced. On the other hand, in less urgent cases, and especially in cases where opium has been given, the patient's life may be prolonged for ten or even fourteen days before death ensues from the unrelieved strangulation. Taking the average it may be said that an unrelieved strangulated hernia will probably bring about a fatal issue within seven days.

The treatment of a strangulated hernia must be prompt and definite. Few maladies are more seriously affected by delay. If a loop of intestine is being strangulated, its condition cannot be improved by delay, and in fact every hour adds to the seriousness of the case, and will hasten the death of the ensnared bowel. In any instance the patient should be placed at once in the recumbent posture in bed, and if the hernia be in the groin the thighs may be flexed by means of pillows under the knees so as to relax the strictures about the seat of rupture. Some slight relief may be given by warm applications to the abdomen. No food should be administered by the mouth. Thirst may be relieved by sucking small pieces of ice, or, if it excites no intestinal movement, by the use of copious enemata of warm water. When these preliminary measures have been adopted, steps should be taken to reduce the hernia. This may be effected either by manipulation, the procedure known as "the taxis," or by the operation of "herniotomy."

Taxis.—By this measure an attempt is made to reduce the hernia into the abdomen by the pressure of the fingers. The patient is placed in a recumbent posture. If the hernia be umbilical the thighs should be well flexed upon the belly so as to relax the anterior abdominal parietes. If it be femoral or inguinal the thigh of the affected side should, with the same object, be flexed and a little adducted. The head and shoulders should be low, and the pelvis be well raised upon pillows, or, still better, the bottom of the bed may be elevated one foot or two. The neck of the hernia should then be steadied between the thumb and forefinger of the left hand. By these digits the hernial orifice is defined, and a kind of funnel-like passage made in front of the hernial ring. The contents of the sac must then be pressed gently towards the abdomen by a combined squeezing and kneading movement. In umbilical and in direct inguinal hernia the pressure must be in a direction horizontally backwards, or backwards and upwards. In oblique inguinal the force must be directed upwards, backwards, and outwards, along the inguinal canal; while in femoral ruptures the force will generally have to be first applied a little downwards until the saphenous opening be cleared, and then directly backwards towards the spine of the pubes. The amount of force to be employed and its duration and repetition must be dictated by common sense, it being borne in mind that the pressure is exercised upon bowel in a softened congested state, or it may be approaching gangrene. When reduction is successful the bowel slips back with a sudden jerk, and often with a characteristic gurgle. Omentum, on the other hand, return more slowly, and of course without gurgle. The importance of the taxis in the treatment of hernia has greatly diminished of late years. If the taxis properly applied fails, the only alternative is herniotomy. Some years ago this operation was not a trifling one; it involved an open wound, and if the sac was divided an opening into the peritoneum.

With the recent improvements in surgery, the gravity of the operation has been considerably reduced. Under antiseptic precaution, the wound generally heals without complication, and the evil consequences of the opening of the peritoneal cavity are no longer to be dreaded. In proportion, therefore, as the operation has been rendered less serious, the application of the taxis, and especially its repetition, has become less momentous.

The advantages of the taxis, if successful, are these. The gut is reduced, no wound is made, the peritoneal cavity is not opened up. The disadvantages of the taxis are, on the other hand, as follows: The gut cannot be seen, and most serious damage may be inflicted by undue pressure upon intestine that is either seriously altered in structure or possibly on the verge of gangrene. Taxis is liable to certain special accidents that are difficult to avoid (page 256). Taxis affords no opportunity of improving the condition of the hernia after its reduction. At the present time there is no excuse for violent or long-continued attempts at taxis. Such attempts expose the bowel to the greatest dangers, and involve more serious risks than does the usual cutting operation.

The advantages of the operation as compared with the taxis are these: (1) The gut can be inspected, and is not exposed to the evils that may attend much handling. (2) The special accidents that attend taxis are not possible. (3) Adhesions and conditions likely to perpetuate the hernia can be dealt with. (4) By the excision and ligature of the sac the rupture may be cured, or at least placed in a more favourable condition. (5) There is no risk of reducing gangrenous or perforated bowel.

When taxis is not to be employed.—(1) In very acute cases, where the symptoms are of great severity, and of rapid development, the use of the taxis adds to the risk by possible damage to the gut, and by causing delay. This especially applies to the acute strangulation of congenital inguinal herniæ. (2) The longer a rupture has been strangulated, the less likely is taxis to be of any avail. Every day lessens the probability of reduction, and increases the possibility of gangrene. If, therefore, marked symptoms of strangulation have existed for three or four days, it would be unwise to delay an operation in order to give an extended trial to taxis. (3) If there be evidence that the rupture was previously irreducible, taxis should not be attempted. (4) Taxis is inadmissible when there is evidence of gangrene of the gut, or of inflammation or sloughing of the sac.

When taxis may be employed.—(1) If the patient be seen within a few hours of the occurrence of strangulation, taxis is very likely to prove of avail. (2) In cases where the symptoms are less pronounced than usual, taxis may effect a reduction after the lapse of twenty-four or forty-eight hours. (3) In the majority of cases the use of taxis may be directed as follows: The patient having been placed in bed, and there being no indications to the contrary, gentle taxis is applied. If it fails, and if the symptoms be urgent, opium may be given, and in half an hour, the patient being anæsthetised, another gentle attempt at taxis is made, and if it fail again the operation is at once performed. If the symptoms are in no way acute an opiate may be given and an ice bag applied to the swelling for an hour or two. At the end of this time taxis may be again attempted, and if it fail an anæsthetic should be at once administered. It is undesirable to administer an anæsthetic for the sole purpose of attempting taxis, and then, in the event of failure, allowing the patient to recover, and then necessitating a second administration of chloroform before any further step can be taken. Before the anæsthetic is given the patient should be told that taxis will once more be tried, but that if it fail, after a reasonable trial, an operation will be forthwith performed.

Certain accidents incident to taxis.—The bowel may be apparently reduced by taxis, and the symptoms of strangulation continue. This persistence may be due, among other causes, to the following accidents:

1. *Reduction en masse.*—In this form the entire sac, together with its contents, are pushed *en bloc* into the abdomen, and if the bowel has been strangulated by the neck of the sac, it is obvious that the symptoms will persist after the apparent reduction. This accident is very rarely met with, except in connection with small femoral herniæ. It is almost unknown in acquired inguinal ruptures, and is impossible in the congenital forms. The accident may be diagnosed by noting that the reduction has been effected very slowly and with difficulty, considerable force having been employed, that the contents have not slipped back, and that there has been no characteristic gurgle. There are, however, no means of at once diagnosing a reduction *en masse* from the reduction of a large piece of omentum. When this accident has occurred, and is recognised by the symptoms persisting, the hernial orifice must be at once cut down upon, the sac secured and drawn down, then opened in the usual way, and the contents reduced or treated as circumstances require.

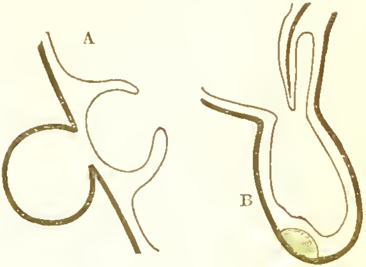


Fig. 19.—A, Reduction en masse; B, reduction en bissac.

2. The peritoneum lining the abdominal parietes around the hernial orifice may become detached. When taxis is applied the neck of the sac is thrust back into the abdomen, a movement permitted by the peritoneum. The sac itself is not reduced, but the hernial contents are thrust into the space provided between the detached peritoneum and the parietes from

which that membrane has been separated. This accident is rare, and would appear to be limited to inguinal ruptures.

3. *Reduction en bissac.*—In congenital inguinal herniæ it has been noted that in certain rare instances a diverticulum extends from the original sac. This diverticulum, or second sac, will come off on the distal side of the neck of the original sac, and will be found to extend upwards between the muscles of the anterior abdominal parietes, or to lie between those muscles and the transversalis fascia, or between that fascia and the peritoneum. In other instances it may be placed in the iliac fossa between the muscle and its fascia, or between that fascia and the peritoneum.

In any instance the strangulated bowel is reduced from the original sac and forced into the diverticulum or second sac, still continuing strangulated by the neck that is common to the two sacs. The phenomena attending such reduction are identical with those associated with reduction *en masse*, and the treatment is the same.

4. *Reduction through a rupture in the neck of the sac.*—" As an effect of forcible and long sustained compression of the hernial tumour, the delicate serous membrane of the sac may be rent, burst, or torn, and the hernia makes its escape through the aperture into the subserous connective tissue; its course outside the peritoneal sac is advanced by continued pressure, and detaching the connections of the neighbouring peritoneum it forms for itself a pouch between that serous membrane and the internal abdominal fascia" (Birkett). This accident is met with in inguinal herniæ, and especially in the congenital form; the rupture is usually at the posterior part of the neck, and the artificial sac takes a direction downwards and outwards. The indications of the accident are the same as those of reduction *en masse*, and are thus

described by Mr. Birkett: "The tumour becomes flaccid, and, therefore, smaller; the bulk of the tumour slowly diminishes as the pressure is continued, until at last very little, if anything, can be felt; but the surgeon has failed to experience that sudden jerk so characteristic of the escape of the hernia from the gripe of the mouth of the sac as it enters the abdominal cavity." The treatment is the same as that already indicated.

The persistence of strangulation and symptoms after complete reduction by taxis or by operation may depend upon these conditions: (1) The gut is hopelessly damaged; it remains *hors de combat.* It maintains the condition of intestinal obstruction, and does not recover from its state of paralysis. (2) The gut has been reduced, still strangled by some old adhesions that existed within the sac, but not connected with it. This condition cannot well occur after an operation in which the sac has been opened. In certain instances a small piece of gut has been strangulated through a hole in some omentum occupying the sac. On reduction the gut and omentum have been returned together, the former still strangulated. (3) Symptoms of acute peritonitis supervene, which, up to a certain point, may imitate the symptoms of strangulation.

In the treatment of the first-named condition the abdomen may be opened about the site of the hernial orifice, and, the damaged gut having been drawn out of the wound, an artificial anus may be established. In some cases it may be considered advisable to resect the damaged loop before establishing the artificial opening. In condition No. 2 the abdomen should be opened near the hernial orifice, and the strangulation relieved by dividing the constricting band. To condition No. 3 is applicable the usual measures adopted for acute peritonitis.

After successful reduction by taxis, the hernia must be prevented from returning by means of a properly applied pad and bandage. No food should be administered until all sickness has ceased, and then the patient should be placed for three or four days upon a slender diet of iced milk and beef tea. The bowels should be kept at rest by means of opium for a week at least. If no untoward symptoms develop, a little solid food may be given on the third day; and, if the bowels are not opened by the seventh day, an enema, followed, if necessary, by a dose of castor oil, may be employed. On no account should any attempt be made to excite the bowels so long as any abdominal pain, colic, or disposition to vomit continues. If all things go well, the patient may get up on the fifth or seventh day if he be provided with a proper truss. In the majority of instances the bowels act spontaneously within forty-eight hours of the reduction. Sometimes diarrhœa, with abdominal pain and nausea, set in. These symptoms, as a rule, depend from some enteritis, starting from the damaged loop of intestine. The symptoms are best met by absolute rest, a milk diet, warm applications to the abdomen, and the free use of opium.

The operation of herniotomy.—In cases of strangulated hernia, when taxis has failed, or when it is considered, for any reason, to be inadmissible, herniotomy should be performed without delay. When the symptoms of strangulation are pronounced, and their character beyond question, there can be no excuse for temporising. Prolonged taxis is to be condemned, and the same must be said of repeated attempts at taxis.

While the anæsthetic is being administered, the skin about the hernia, if it be inguinal, may be shaved and the parts thoroughly cleaned. The whole procedure should be carried out under strict antiseptic precautions. The incision varies according to the site of the rupture. In *inguinal hernia,* an incision from one and a half to two inches in length is made over the external abdominal ring in the long axis of the swelling. The centre of the incision should correspond to the centre of the ring. In dividing the subcutaneous tissues the superior external pudic artery will be cut, and may bleed freely. The various layers of tissue that cover the sac must be then carefully divided. The cremaster is the only structure, however, that is likely to be recognised. It is not always easy to recognise the sac. It is usually of a blueish aspect, and presents arborescent vessels; it varies greatly in thickness and density. When the sac has been reached, the finger is carried along it into the inguinal canal to search for the constriction. When this has been found, the hernia director, guided by the finger, is passed beneath the constriction, which is then divided by the hernia knife by cutting directly upwards.

In *femoral hernia* the incision is made along the inner side of the tumour, is vertical, about one and a half inches in length, and so planned that the centre of the incision will correspond to the top of the saphenous opening. The sac is reached in the usual way, and the constriction will usually be found at the femoral ring, and will be caused mainly by Gimbernat's ligament. The stricture is divided by cutting upwards and inwards.

In *umbilical hernia* the incision is vertical, is made in the middle line, is about two inches in length, and is so arranged that the centre of the incision will correspond to the highest point of the hernial orifice. The stricture cannot be divided without opening the sac.

It has been already pointed out that the gut may be strangulated, not by a constriction outside the sac, but by the neck of the sac itself. In such a case it is evident that a division of the external stricture will not liberate the ensnared intestine, but that it will be necessary to open the sac itself. Independently, however, of these cases, there remains the question as to whether the sac should or should not be opened in ordinary instances.

This question, which was at one time considered of very great importance, is regarded at the present day as of much less moment. Against the opening of the sac it was urged that the peritoneum would be opened, that the gut would be exposed, and that if bleeding occurred after the closure of the wound, it would take place into the abdominal cavity.

Since the introduction of Listerism and the operations for the final closure of the sac these objections have ceased to have much weight. The advantages of opening the sac are these: The gut can be inspected, the risk of returning gangrenous bowel, or bowel strangulated by bands independent of the sac, is removed, and the operation for the final closure of the sac is more readily effected. The sac need not be opened as a matter of routine. In quite recent cases where no taxis has been tried, and where there is no reason to expect a serious condition of the bowel, it is not necessary that the sac be opened, if the stricture that holds the bowel be entirely without the sac. In the majority of instances, however, it is no doubt well that the sac should be opened.

Management of the intestine.—(*a*) If the bowel be still smooth and glistening and of purple colour, and if it feel firm and elastic to the touch, it would be returned into the abdomen as soon as the stricture has been divided.

(*b*) If on opening the sac it is found that only a very minute piece of intestine is strangulated, the loop so involved should be gently held while the stricture is being divided. If this precaution be not adopted, the loop may slip suddenly back into the abdomen on being set free by the knife.

(*c*) In any instance the gut must be handled with the greatest care.

(*d*) Before the loop is reduced a little more bowel may be drawn down so as to expose the line of strangulation. It is possible that the loop itself may appear fit for reduction while ulceration exists at the stricture line.

(*e*) If the gut be black, dull, and sticky on the surface, and has quite lost its resilience, it must be regarded as beyond recovery.

Treatment of gangrenous bowel.—When, after examination, the gut must be regarded as damaged beyond recovery, one of two courses may be adopted. Either to leave the damaged bowel to slough off in the sac and await the formation of a fæcal fistula, or at once to excise the gangrenous loop of intestine, and unite by suture the cut extremities of the gut.

There are considerations which may be urged in favour of and against either of these proceedings.

A patient in whose case strangulation had existed long enough to produce gangrene of the bowel is generally so exhausted as to be but little fitted to bear the shock of the further operation necessary to remove and suture the portion of affected bowel. If the individual survive, the condition of the parts operated upon are often most unfavourablo for sound and rapid union. Beyond the area of the gangrened portion there will be a zone of inflammatory infiltration. In some cases it will be difficult to determine exactly at what point it is safe to divide the intestine so as to be quite clear of the damaged parts. The contents of the sac will be in a septic condition, and it may be afterwards difficult to ensuro purity of the wound. The intestine also is generally distended by fluid fæces, and not in the empty flaccid condition to be met with in a patient who has been previously prepared for the operation. This circumstance adds much to the difficulties of the operation. Certainly in many instances the general condition of the patient will be such as to forbid any severe operative procedure. In these the sac had best be laid freely open, a charcoal poultice applied, or the part sprinkled with iodoform. If the prolapsed loop be much distended, an opening may be made into it with the knife or scissors. There is difference of opinion as to whether the neck of the sac should be incised and the stricture divided. It is objected that this may separate the adhesions which shut off the general cavity of the abdomen. But if carefully done there need be little risk of this, as the adhesions usually extend inside considerably beyond the seat of the stricture.

The advantage of freeing the stricture consists in allowing the natural circulation to be restored in the prolapsed portion, and whatever may not be hopelessly damaged recovers its vitality.

As a general rule, therefore, I should advise in cases of gangrenous bowel that the stricture should be carefully liberated, and the prolapse left otherwise undisturbed in the open sac.

In cases, however, where only a limited portion of bowel is affected by gangrene, or where it is perforated merely at one point, and the patient's strength has been well maintained, it may be better at once to excise the affected portion of the gut and unite the divided edges by a double row of sutures. The first row should merely include the edges of the serous membrane, and the second a portion of the peritoneal surface and subjacent tissue, excluding the mucous membrane. The needle, armed with a fine silk thread, is first introduced a little more than half an inch from the margin of the bowel, then passed for a quarter of an inch beneath the surface, and made to emerge about an eighth of an inch from the free margin. The needle is then passed in a similar manner, but in a reverse direction, through the opposite side of the bowel. This second row is inserted in such a way that when drawn together a surface of at least a quarter of an inch of the upper and lower end of the bowel will be brought into close contact all round, and the first sutured margin of the bowel will be inverted toward the lumen of the tube (Czerny's method, Fig. 20). In other cases only one row has been inserted, after the manner of Gegenbauer (Fig. 21). But the former plan is safer and better. When the portion removed exceeds half an inch, it will be necessary to remove a V-shaped portion of mesentery as well. The cut edges of this should first be sutured. It is of moment to take care that the part next the intestine be very accurately and closely brought together, as here is the weak point in the chain of sutures. Of course all bleeding must first be carefully arrested and the wound purified. The ends of the divided intestine may be held between the fingers and thumbs of an assistant to prevent any escape of their contents, or secured by clamps whose blades are protected by indiarubber.

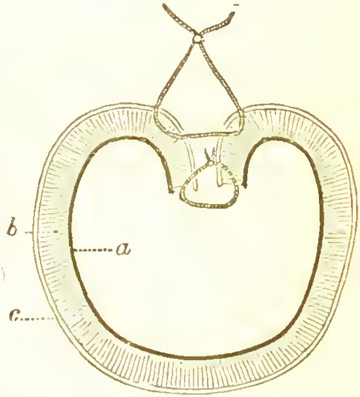


Fig. 20.—Czerny's Suture.

a, Mucous membrane; *b*, muscular coat; *c*, serous coat. (From Treves' "Intestinal Obstruction.")

When the operation is completed, the parts are to be returned to the abdominal cavity, the wound closed, and a drainage tube inserted. The prospects of recovery are good if the patient survive the shock, and peritonitis do not occur. Even a slight fæcal discharge, which may occur some days later, does not exclude the prospect of a final complete recovery. The parts are surrounded by adhesions, and the opening caused by premature yielding of some of the sutures may after a time close.

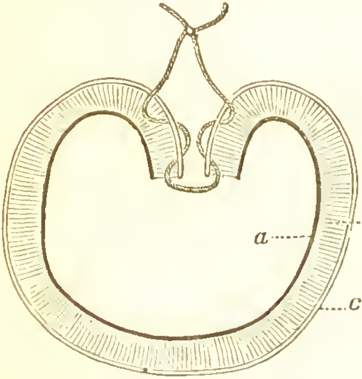


Fig. 21.—Gegenbauer's Suture.

a, Mucous coat; *b*, muscular coat; *c*, serous coat. (From Treves' "Intestinal Obstruction.")

If it be decided for any reason to leave the hernia unreduced, the time must be awaited when a fæcal fistula has been established, and the patient's health and strength are sufficiently restored. In some cases where the fistula has been the result of a small perforation, and there is no loss of bowel substance, or only a trifling one, the fistula may spontaneously close. This is an unusual result; generally a considerable portion of the bowel wall has perished. By degrees the posterior surface projects towards the fistulous opening, there being no resistance in that direction. This projection gradually assumes a valvular form, and has been called by Dupuytren the *éperon*. This will more or less completely shut off the lower opening of the intestine, and direct the contents towards the fistula, while the bowel below becomes collapsed and contracted in calibre.

In certain favourable cases the valve-like process may be cut through by the application of Dupuytren's clamp. The continuity of the bowel may be thus restored. The fæces have no longer the same tendency to escape, and the fistulous opening gradually closes, or a plastic operation to close it may be performed. The application of the clamp is not free from risk of setting up peritonitis, and is uncertain in its results. Where it has failed, or where for other reasons it is inapplicable, a more radical method has been of late years adopted.

This consists in carefully detaching the margins of the fistula and portion of the intestine adherent to the abdominal wall, drawing the ends out of the wound, cutting a portion off each extremity, and then suturing the divided ends together in the manner already described. As the lower end is usually much contracted it may be well to cut it off obliquely, to render the margin longer and better fitted to adjust exactly to the upper end. When thus performed, this operation is much less dangerous to life than when undertaken at the time of the strangulation. The patient must be carefully prepared beforehand by emptying the intestine, and giving as little food as possible for the twenty-four hours preceding. The region of the fistula itself must be thoroughly purified and the bowel repeatedly washed out from the opening. The after-treatment consists in keeping the patient under the influence of opium to maintain the intestine quiescent.

Treatment of wounded intestine.—The bowel may be wounded during an operation for hernia, either by mistaking the sac, by reason of adhesions of the bowel to the sac, or more frequently during the division of the stricture. If only the peritoneal investment be divided, the bowel may be returned. It is not necessary to introduce sutures. If the wound be complete, however, it must be closed by the introduction of a sufficient number of Lembert sutures of fine silk or catgut, and then replaced.

It can seldom be necessary to establish an artificial anus by attaching the margins of the divided bowel to the skin wound.

Wound of the arteries.—The obturator or epigastric arteries, lying as they do close to the neck of the sac, are sometimes wounded during the incision of the stricture. The accident is somewhat rare, and is impossible if proper care be taken. The bleeding may take place internally or externally. In the former case the diagnosis may not be made until signs of loss of blood show themselves.

The best procedure is to enlarge the existing wound sufficiently to expose the vessel at the point injured, and apply a ligature above and below the wound. Compression is not to be recommended.

Secondary hæmorrhage, often repeated, has been occasionally observed from these vessels. The same treatment will apply. But in this case, as the bleeding will have been determined by some general cause, the result is less likely to be satisfactory.

Management of omentum.—(*a*) If the omentum be healthy it should be returned into the abdomen. If seriously changed by previous attacks of inflammation, by which its folds have become adherent, it will be better to remove it.

(*b*) If it be very acutely strangulated it is better that the involved part be excised. A clamp having been applied, the mass is removed with scissors, and the divided vessels having been separately secured by catgut ligatures, the stump is reduced into the abdomen; or the portion to be removed having been firmly tied with two or more silken ligatures may be cut off, and the stump reduced.

(*c*) If the omentum be adherent it should not be allowed to remain in the sac, but should be excised in the manner first named.

(*d*) If the omentum be left in the sac it is apt to become inflamed and to suppurate, besides ensuring the positive recurrence of the hernia.

Management of adhesions.—Recent adhesions may be broken down with the finger. This procedure requires care, for when such adhesions are attached to the bowel they sometimes cover small perforating ulcers.

Older adhesions may be simply cut, and any bleeding point secured; but old adhesions that are large and vascular may require to be ligatured in two places before they are divided.

Management of the sac.—After the complete emptying of its contents the sac should be treated as described in the section on radical cure. It should be excised in whole or in part, its neck secured as high up as possible by a catgut ligature, and the hernial orifice closed by two or more points of suture.

If the sac is acutely inflamed this procedure should not be attempted; and the same applies to instances where the parts have sloughed or have undergone suppuration.

The after-treatment.—The patient should be kept in the recumbent position with his knees flexed over a pillow. As soon as he has recovered from the effects of the anæsthetic an injection of morphia should be given. No food should be administered by the mouth for at least thirty-six hours. The patient may have a little ice to suck to relieve his thirst, and if there be much prostration the strength may be supported by enemata of peptonised beef tea with a little brandy.

Any abdominal pain should be met by hypodermic injections of morphia. The bowels should be kept quiet until the seventh day, and if they have not spontaneously acted by that time, and all the symptoms are favourable, an enema may be administered. No harm will arise, however, from a further delay up to ten or twelve days from the date of operation, when the bowels will probably act spontaneously. The drain if one be used, may be removed from the wound at the end of forty-eight hours, and the sutures taken out on the third or fourth day. In most cases the antiseptic dressings may be discontinued on the tenth day, and the wound then treated with iodoform or boracic lint. Firm pressure should be maintained over the part until the wound is quite sound. The patient should be kept in bed for at least three weeks, and at the end of a month the parts may be sufficiently recovered to allow a truss to be applied if such be required. The patient must not rise without a truss or a properly applied pad and spica bandage.

Accidents after operation.—1. The reduced gut may remain *hors de combat*, and being entirely paralysed, the symptoms of intestinal obstruction may continue.

2. Diffuse peritonitis may supervene. In most instances this is due to the giving way of the bowel after its reduction into the abdomen. The perforation is usually small, fæcal extravasation occurs, and a fatal peritonitis follows.

3. Some amount of local peritonitis may supervene, and need not occasion any alarm as to the final issue of the case.

4. Acute enteritis may sometimes be induced. This inflammation, no doubt, spreads from the strangulated loop, and tends to attack the hyperæmic bowel above the seat of strangulation. The symptoms are the following: Severe intermittent colicky pains in the abdomen, which are often lessened rather than increased by pressure. Diarrhœa with the passage of

stools, that are usually dark-coloured, and often mixed with blood. Some vomiting, which is never severe and never stercoraceous. The abdomen is sunken, and there is an absence of any tympanitic distension. The condition is best met by absolute rest, by a diet of iced milk only, by the free use of opium, and the application of warm fomentations to the abdomen.

5. The intestine, reduced by taxis, or operation, has in certain instances become the seat of stricture, and the adhesions that sometimes form about the hernial opening have been the cause of fatal intestinal obstruction.

Omentum that is fixed in a hernia may form an omental ligament that may produce a strangulation.

Treatment of strangulated hernia by aspiration.—Dieulafoy attempted the relief of strangulated rupture by thrusting an aspirator into the sac. A fine needle, with a diameter not exceeding $\frac{1}{20}$ inch, is used, and is thrust if necessary into the tumour in several places. The procedure reduces the swelling by removing the fluid from the sac, and by permitting the escape of gaseous and liquid matters from the gut. This method has not been extensively adopted, nor can it be recommended. It is associated with risk and uncertainty, and has in perhaps the majority of cases proved unsuccessful.

THE ANATOMICAL FORMS OF HERNIA.

Inguinal.—This is the most common form of hernia. It occurs with greatest frequency between the ages of twenty and forty, and after that between the ages of one and twenty. It is much more common in men than in women. It is comparatively rare in female adults. It is not infrequently met with in young girls. Indeed, it is almost the only form of rupture that is met with in female children under the age of five years. In such cases it is of congenital origin, and depends upon imperfect closure of the canal of Nuck.

Inguinal herniæ may be divided into two classes: 1. *The acquired form.* 2. The varieties that depend upon imperfect closure of the vaginal process of peritoneum. These taken collectively are commonly spoken of as *congenital.*

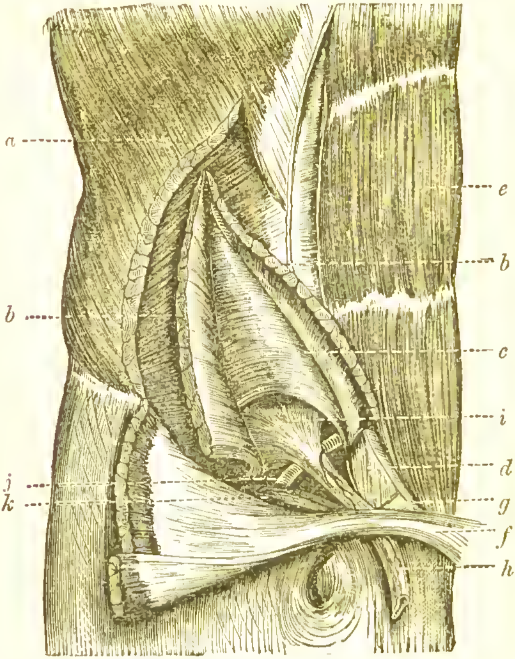


Fig. 22.—Inguinal Hernia.

a, External oblique; *b*, internal oblique; *c*, transversalis; *d*, conjoined tendon; *e*, rectus; *f*, Poupart's ligament; *g*, triangular ligament; *h*, cord; *i*, infundibuliform fascia; *j*, epigastric artery; *k*, pubes.

1. **Acquired inguinal hernia** may appear under one or two aspects. (*a*) The oblique or indirect rupture is the most common of all herniæ. The protrusion in this form descends along the inguinal canal,

the neck of the sac being to the outer side of the deep epigastric artery. As the hernia increases it escapes from the external abdominal ring, and descends into the scrotum or labium major (scrotal or labial hernia). Any form of inguinal rupture in which the protrusion has not extended beyond the external abdominal ring is called a bubonocele. The coverings of this hernia are the following: The skin, the superficial fascia, the intercolumnar fascia, the cremaster muscle, the infundibuliform fascia, the subserous tissue, and the peritoneum (Fig. 22).

When strangulation occurs the constriction is usually at the neck of the sac, or it may be caused by the pillars of the external abdominal ring.

The rupture lies in front of the spermatic cord, and when it has descended into the scrotum is separated from the testicle by the tunica vaginalis.

In its early stages the hernia may present a long and narrow neck, formed by that part of the sac which lies between the two abdominal rings. As the rupture becomes pendulous, however, the two rings are approximated by the constant dragging upon the internal orifice, the neck becomes considerably shortened, and in old scrotal herniæ, after reduction, the finger can be passed almost directly into the abdomen and the inguinal canal, as a long and oblique passage has ceased to exist.

(*b*) In the direct inguinal hernia the gut makes its escape through Hesselbach's triangle to the inner side of the deep epigastric artery. It enters the inguinal canal at a lower point than the oblique form. It usually passes to the outer side of the conjoined tendon, and may be a little deflected outwards when that structure is very rigid.

The coverings of the sac are these: The skin, the superficial and intercolumnar fasciæ, the cremasteric fascia (except in instances where the gut has forced its way *through* the conjoined tendon), the transversalis fascia, and the subserous tissue.

When strangulation occurs the agent is usually the conjoined tendon, though the obstruction may be brought about by the neck of the sac.

Direct herniæ differ, moreover, from indirect in the following points: They are never congenital; they are usually smaller and more globular; they are more liable to strangulation. On reduction they pass back in a more direct manner, and if the finger be placed in the hernial orifice it may be possible to detect the pulsations of the epigastric artery on the outer side of the opening.

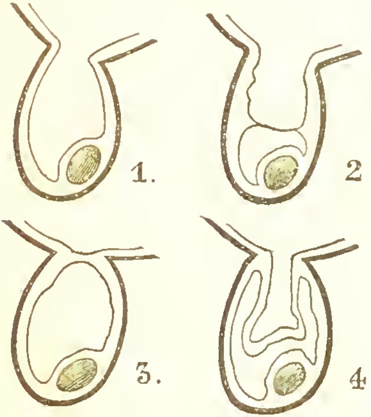


Fig. 23.—1, Congenital hernia; 2, hernia into the funicular process; 3 and 4, conditions for infantile hernia.

2. **Herniæ depending upon congenital defects in the processus vaginalis.**—The testicle, in its descent from the abdomen into the scrotum, is accompanied by a process or tube of peritoneum. This diverticulum at, before, or soon after birth, becomes shut off from the general peritoneal cavity, and persists at the tunica vaginalis. It would appear that in the process of closing the processus becomes occluded at two points, one being at the internal ring, and the other at the top of the epididymis. The part of the tube that remains between these two points occupies the whole of the inguinal canal. It soon shrinks, and is represented in a few months by a simple fibrous cord. Should

any portion of this segment of the tube not be obliterated, then it may at some time be the seat of an accumulation of fluid, and constitute an "encysted hydrocele of the cord."

Now, three circumstances may occur in connection with the vaginal process. (1) The process may remain patent throughout, unclosed at any point. (2) It may be occluded at the lower point only; *i.e.* just above the epididymis. (3) It may be occluded at the upper point only; *i.e.* at the internal ring. When a hernia develops in connection with the first-named defect it is called "*congenital;*" when one develops in connection with the second-named defect, it is called a "*hernia into the funicular process;*" and when with the third defect, "*an infantile or encysted hernia*" (Fig. 23).

The *congenital hernia* appears at birth or within a few weeks or months of birth. It may appear for the first time when the child begins to run about at the age of two or three years, and in certain cases, under conditions to be described later on, it may make its descent for the first time in adult life. The gut descends along the patent vaginal process and enters the scrotum. In its progress it follows the inguinal canal lying in front of the cord (Fig. 24).

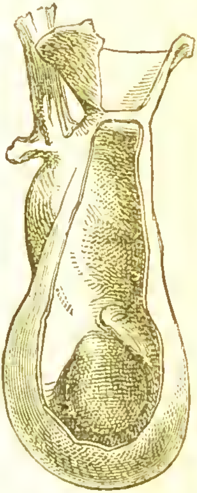


Fig. 24.—Congenital Inguinal Hernia.

This hernia differs from the acquired oblique rupture in the following points: It appears in infants or children; it develops suddenly, and may descend at once into the scrotum. It envelops and conceals the testicle, whereas in the acquired rupture the testis is felt below the sac, and quite distinct from it. In the congenital form the internal ring is not dragged down; the inguinal canal does not become shortened as it does in the acquired variety: the neck of the sac, therefore, remains long and narrow, and thus it happens that these ruptures, when strangulated, are much more difficult to reduce than are those of slow formation. Lastly, the congenital hernia is more liable to strangulation, and to certain accidents after taxis, viz. reduction en bissac, and reduction through a rupture about the neck of the sac.

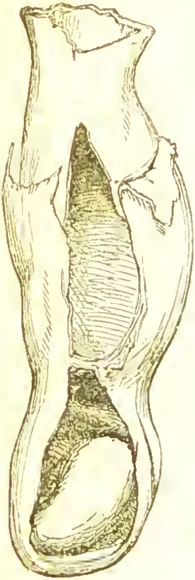


Fig. 25. — Hernia into the Funicular Process.

In some forms of congenital hernia, a constriction exists in the sac about a third of the way down. This constitutes the somewhat rare variety known as "*the hour-glass hernia.*" It is due to an incomplete closure of the vaginal process.

The congenital rupture may be associated with a retained testis. When this complication exists, no truss should be worn until the child begins to run about, until, indeed, the second year. If at the end of that time the testis has not descended, then both it and the rupture must be maintained by a truss, because the patient will begin to run the risk of strangulation. Many of the milder forms of congenital hernia have been cured by the persistent use of a good truss.

The hernia into the funicular process appears at the same periods of life and under the same circumstances as the variety just named. Indeed, it resembles the congenital form in *all* respects, save that, instead of enveloping the testis, that body can be felt below the rupture, and quite distinct from it. The gut descends along the open vaginal process as far as the epididymis, where it is arrested. This form is as common as the congenital (Figs. 23 and 25).

In the infantile hernia a septum exists at the internal ring, between the peritoneal cavity above and the tunica vaginalis below, which extends as high as the internal ring. If this septum is pressed upon, it may yield in the direction of the testis. By further yielding it forms a sac for the rupture, and this sac projects into the tunica vaginalis as the "knock-up" of a wine bottle projects into the bottle cavity. Thus a hernia is formed, which appears to have two sacs (Fig. 23). It is rare, and cannot be diagnosed until the parts are cut down upon. The hernia forms slowly, is met with in infants, in young children, and also in young adults. The testis is found below the swelling, and quite distinct from it.

Cases have occurred where a hernia, having all the characters of a congenital rupture, has developed suddenly in an adult after violent exertion. It cannot be supposed that in such a case the vaginal process has remained patent up to adult life, and yet led to no evidence of rupture. It is pretty clear that in these cases a septum exists, such as is met with in the condition that leads to infantile hernia. Under violent exertion that septum does not yield, but suddenly gives way, and the gut descends at a bound to the bottom of the scrotum, having entered the large tunica vaginalis (Fig. 23; 3).

The diagnosis of an inguinal hernia presents, in the great majority of cases, no difficulty. There is the history of the case, and the fact that the swelling occupies the inguinal opening, and that its upper limit cannot be defined. The rupture is, moreover, commonly tympanitic, reducible, and with an impulse on coughing. It is opaque, whereas hydrocele of the part will be translucent. An encysted hydrocele of the cord, moreover, can be moved by dragging upon the cord, and its upper limits can generally be made out. The term, diffused hydrocele of the cord, is applied to a collection of peritoneal fluid in the open processus vaginalis. This collection is translucent, returns gradually on lifting the scrotum, and if, after it has disappeared, the patient stands up, the tumour will fill from the bottom, and not from the top as a hernia does. Sometimes a hydrocele extends into the inguinal canal, but its characters otherwise serve to distinguish it from hernia. A search for the testicles in the scrotum should prevent a retained testicle in the canal from being mistaken for a hernia.

Femoral or crural hernia is rare before the age of twenty, and is most common between the ages of twenty and forty. It is never congenital, and is much more common in women than in men. The rupture descends along the femoral canal, and has the following coverings: The skin, the superficial and cribriform fasciæ, the crural sheath, the septum crurale, the subserous tissue, and peritoneum. The neck of the sac will be at the femoral ring, and the strangulating agent is very usually Gimbernat's ligament. The relations of the deep epigastric and obturator arteries to the neck of this hernia must be borne in mind. Femoral herniæ are, as a rule, of comparatively small size. When large the tumour usually mounts up over Poupart's ligament. In this position it may imitate an inguinal hernia. The matter can be readily settled by noting that a femoral rupture will always lie to the outer side of the pubic spine, while an inguinal rupture will lie to the inner side. The pubic spine can be felt in the male by invaginating the scrotum, and in the female by abducting the thigh so as to render distinct the sharp tendon of the adductor longus. The finger passed along this tendon will be guided to the point of bone.

The diagnosis of a femoral hernia.—The following points in the differential diagnosis may be noted. A psoas abscess has an impulse on coughing, enlarges on coughing and on standing up, and may be more or less reducible. Unlike the hernia, however, it is always dull on percussion; it descends as a rule to the outer side of the femoral vessels, and is attended by the other manifestations of spinal abscess. A limited varix of the femoral or internal saphenous veins may imitate rupture to some extent. But when the patient is erect, pressure upon the crural ring will prevent the descent of a rupture, while it will increase the size of a varicose swelling. An enlarged gland cannot well be mistaken for a hernia, unless it be for a small irreducible epiplocele.

Umbilical hernia is met with in three forms: 1. Congenital. 2. Infantile. 3. The hernia of adults.

1. The congenital form is very rare. It depends upon imperfect closure of the ventral plates, and in some monsters all the viscera may be contained in the protrusion. In most cases a small tumour is produced at the root of the umbilical cord. The sac extends into the cord and is covered by its tissues. In securing the funis after birth both the sac and intestines have been inadvertently enclosed in the ligature. The sac may give way and the contents protrude. The hernia may become strangulated.

2. The infantile form is the most common, and is due to a yielding of the umbilical cicatrix after the separation of the cord. It is usually quite small, has little tendency to increase, and if left to itself has a great disposition to undergo spontaneous cure. It is exceedingly rare to meet in an adult with an umbilical hernia that has existed since infancy.

These herniæ are most readily treated by reducing the rupture and approximating the margins of the hernial aperture by strapping, applied in the same manner as it is used in hare-lip operations.

The hernia is often caused to persist by the use of bandages carrying buttons. These so-called trusses merely prevent the hernial aperture from closing.

3. The umbilical hernia of adults has rarely any relation to the infantile form. It usually develops *de novo* in individuals about or past middle life. It is more common in women than in men, and is most frequent in the obese and in females who have borne many children. The tumour may attain great size, and may reach to the groin. It usually contains a part of the transverse colon and a large quantity of the omentum. It may contain the stomach. These herniæ are apt to become irreducible or incarcerated. In many cases where the tumour is irreducible little can be done but to support the hernia with a suitable belt, unless some form of so-called radical cure is undertaken.

Ventral hernia.—This term is applied to protrusions at other parts of the anterior abdominal parietes than the umbilicus.

Such ruptures are most common in the linea alba, and follow laparotomy wounds. They may also follow upon accidental wounds, or incisions made for the ligature of the iliac arteries, upon destructive suppuration in the parietes, and upon ascites. These herniæ may attain great size, but usually give little trouble. The aperture is large, and they have little disposition to become incarcerated or strangulated. The only treatment required in most cases is a well-applied abdominal belt.

Obturator hernia.—In this form the hernia passes through the obturator fascia, or the obturator canal. In any case the neck will be at the thyroid foramen, usually at its upper margin. The sac may be covered by the obturator fascia. The sac, when fully formed, lies below the horizontal ramus of the pubes, above the adductor brevis, to the outer side of the adductor longus, and under cover of the pectineus. It is placed to the inner side of the hip joint and usually to the inner side of the femoral vessels. The hernia is rare. It is met with in adults, mostly between the ages of forty and forty-five, and is almost limited to the female sex. The condition is exceedingly rare in men. The hernia can hardly be diagnosed unless it become strangulated. In such a case there will be the absence of local signs of strangulated hernia elsewhere, while a slight and possibly tender swelling is felt under the pectineus. The neck of the sac may possibly be reached by the finger in the vagina. There is pain on moving the hip, especially in rotation outwards, and pain along the course of the obturator nerve. The hernia has been reduced by taxis with success. Thirteen cases of herniotomy in this situation have been recorded, and of this number four recovered and nine died (Fig. 26).

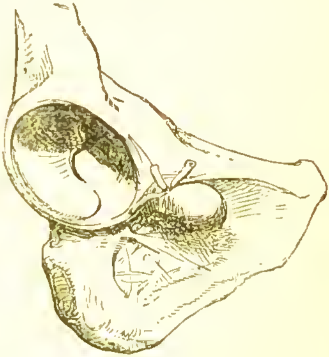


Fig. 26.—Obturator Hernia.

Lumbar hernia is rare. The protrusion occurs either through the quadratus lumborum or the fascia lumborum at the outer edge of that muscle. The internal oblique muscle is then penetrated and the sac appears on the surface at Petit's triangle, the little space beneath the borders of the external oblique and latissimus dorsi muscles and the crest of the ilium.

Sciatic hernia.—Here the sac passes through the great sacro-sciatic notch, above or below the pyriformis muscle. It then causes a projection beneath the gluteus maximus, or may even escape below the margin of that muscle. It is one of the least common varieties (Fig. 27).

Perinæal hernia.—The protrusion occurs between the prostate and rectum or the vagina and rectum. The sac escapes between the fibres of the levator ani and forms a projection in the perinæum. These herniæ are mostly met with in females, and may contain the bladder.

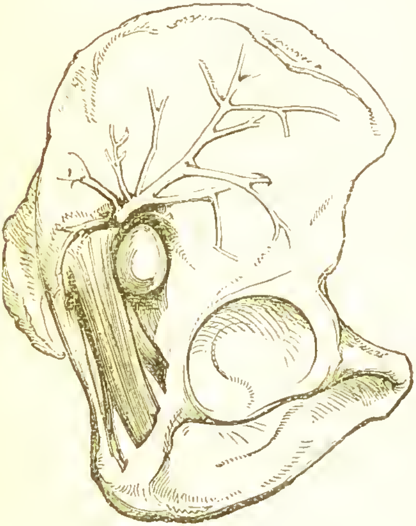


Fig. 27.—Sciatic Hernia.

Pudendal hernia.—The protrusion is found at the posterior and inferior part of the labium, and the neck of the sac lies between the pubic ramus and the vagina. The hernia has been mistaken for vulvar cyst. It is usually quite reducible and gives little or no trouble.

Diaphragmatic hernia is of little practical importance. In the great majority of the recorded cases the condition was never recognised during life. Even if diagnosed the hernia is not capable of being treated. Three varieties are described: 1. The congenital form. This is the most common. It depends upon an imperfect closure of the diaphragmatic septum in the fœtus, and is nearly always met with on the left side. When such a congenital gap exists some of the abdominal viscera may find their way into the thorax. The stomach is the organ most usually herniated, and next in frequency is the colon, and then the small intestines. In some cases this hernia has caused comparatively little trouble. 2. The hernial orifice is produced by an enlargement, congenitally acquired, of one of the normal openings in the diaphragm. 3. The traumatic form. This variety, which is not uncommon, depends upon rupture of the diaphragm by violence, usually due to extensive fractures of the ribs. Some of the abdominal viscera are displaced into the thorax through the rent. The condition is practically limited to the left side, and in the majority of cases the injury is soon followed by death. This lesion is, at the present time at least, beyond the reach of relief by surgical means.

VIII. DISEASES OF THE RECTUM.

HARRISON CRIPPS.

CONGENITAL MALFORMATIONS.

RECTAL malformation results from arrest of development in early fœtal life. The following include the chief varieties :

1. The anus more or less clearly defined, terminating in a cul-de-sac, at a certain distance from the orifice.

2. The complete absence of the anus, the fold of the scrotum extending back in an unbroken line to the coccyx.

3. The anus and rectum well formed, and of normal calibre, but the latter obstructed by a delicate fold of membrane stretching across its interior.

4. The anus is perfectly formed, but the outlet obstructed by a tail-like fold of skin, containing muscular fibre, extending from the scrotum to the coccyx. A small opening existing on one or both sides of the fold.

5. The bowel opening into some portion of the genito-urinary tract. In the female this is by a communication through the posterior wall of the vagina ; in the male, usually by an opening between the rectum and the base of the bladder or prostatic portion of the urethra.

Symptoms.—The symptoms of congenital obstruction are generally too clear to admit of error in diagnosis. Nevertheless, a difficulty will sometimes arise. I have made a post-mortem on an infant, in whom Littré's operation had been performed for supposed imperforation, and found that the symptoms had not been due to an imperforate rectum, but to a volvulus of the small intestine. Several similar mistakes have been recorded.

Treatment.—In the exceptional cases in which a mere membranous septum occludes the bowel, it would be quite proper to perforate the obstruction with a narrow knife; but in the majority of instances the practice of thrusting a knife or trocar blindly into the cul-de-sac is generally futile, and always dangerous. The child being placed in the lithotomy position, a longitudinal incision should be made exactly in the middle line over the site of the absent anus. In cases where the bowel is near the surface, after making the incision it will bulge into the wound, and can be opened sufficiently freely to admit a moderate-sized little finger. If there is no indication of the immediate presence of the bowel, the incision may be carried back to the tip of the coccyx. After this incision the bleeding vessels should be at once tied. The bowel may now be carefully sought by continuing the dissection slowly upwards in the middle line. In the majority of cases the bowel will be found within an inch or an inch and a half from the surface. It should be freely opened; but I advise against any attempt to drag it down and stitch it to the skin. If after careful dissection *in situ* the operator fails to find the bowel, he may perform Littré's operation. In the female, when the bowel communicates with the posterior wall of the vagina, provided the fistulous communication be of sufficient extent to allow a fair passage, operative interference may be advantageously deferred for a few months.

Great care is required, after operation for imperforate rectum, to prevent the new opening from contracting. A conical vulcanite bougie should be passed daily. As the child increases in age the tendency to contract diminishes, and some of those cases that have lived to adult age have shown scarcely a trace of their infantile obstruction.

HÆMORRHOIDS.

Hæmorrhoids are divided into two varieties: 1. External hæmorrhoids. 2. Internal hæmorrhoids.

It is not uncommon to find both forms in the same patient. The disease is described as external when affecting the cutaneous or muco-cutaneous folds about the anus, external to the sphincter muscle. In internal piles the disease originates in the mucous membrane within the bowel. Gradually by prolapse, or, more rapidly from the swelling of inflammation, internal piles sometimes become extruded so as to be external to the sphincter. Nevertheless, they still retain the name of internal piles.

External piles are conveniently considered as presenting three varieties:

1. Thrombotic pile, dependent upon an inflamed or ruptured vein.
2. Œdematous pile, due to a swollen or inflamed state of one or more of the muco-cutaneous folds.
3. Cutaneous pile, due to flaps or tags of skin, consisting of permanently hypertrophied folds of integument.

The two latter divisions are not strictly hæmorrhoidal, but they are so universally spoken of under this appellation as to make a change in nomenclature undesirable.

Thrombotic pile.—Simple dilatation of the anal plexus is no abnormal condition, and takes place more or less in every act of defæcation or straining. It sometimes happens, whilst passing a motion or straining from other causes, a slight sudden pricking sensation will be felt, and soon afterwards a small lump will be observed at the anal margin. It is often very hard, feeling like a pea beneath the surface. On examination it will be found covered by slightly reddened true skin, or, if near the mucous membrane, it shows a dark purple colour though the thin muco-cutaneous integument. Sometimes the little tumour will disappear in a few days, at others it will remain longer, though without giving trouble. Occasionally it will give rise to swelling and inflammation, or even cause a small abscess. If the little tumour be cut into, it will be found to consist of a drop or two of coagulated blood. When occurring suddenly after straining, it is caused by the subcutaneous rupture of a small vein. When it forms more gradually, it is rather of the nature of a thrombus formed within a dilated venous pouch. The cause of this coagulation within the vein may be due to partial laceration of its coats, but it is more commonly secondary to some inflammation spreading from a crack or fissure in the muco-cutaneous surface.

Œdematous pile.—This variety is extremely common, and forms a large proportion of what patients describe as "an attack of the piles." Such attacks vary greatly in degree. In slight cases little more than irritation of the part is complained of, while, in the more severe, acute pain may be experienced, with some constitutional disturbance. It will be found in the latter case, upon questioning the patient, that the trouble commenced a day or two previously with a sense of irritation and heat in the part. The irritation has now passed on to actual pain, especially on attempting to pass a motion. A sensation of fulness or swelling about the rectum will also be complained of. On examining the part in a slight case, a small swelling of a rose-red or semitransparent appearance is seen at the anal margin, consisting of a fold of the muco-cutaneous surface in an inflamed and œdematous condition. Upon gently everting this fold so as to expose its mucous aspect, there may frequently be found, just at the junction of the skin and mucous membrane, a little superficial excoriation or crack. If there be two swollen folds at the anal margin, the excoriation will be at the bottom of the sulcus, between the two. This simple crack or excoriation explains the presence of the œdematous pile, which is merely one or more of the anal folds swollen as the result of inflammation attacking the excoriated surface at its base.

If the patient be in good health the lesion quickly heals, and with it disappears the external pile. If the patient's general health be impaired by gout, alcohol, or other causes, the attack may be much more severe. The pain may be so great as to prevent defæcation, notwithstanding a teasing sensation as if the bowels required relief, while a raised temperature and a quickened pulse indicate a general febrile disturbance. In such an attack the swellings about the anus are large, red, and shining; or the whole orifice may be surrounded by a ring of swollen œdematous tissue drawn here and there into sulci.

If the swelling be excessive the mucous membrane itself may be involved in the œdema, and will be partly everted from the anus.

Cutaneous pile.—In this disorder, tags or flaps of skin are seen about the anus. These may be little more than slight enlargement of the normal anal folds. In other cases they form thin flaps of considerable size, or even pedunculated tumours. After removal they can be seen to consist of a thickened mucocutaneous surface, with an interior composed of fibrous tissue and atrophied blood-vessels. This form of pile appears to result from the hypertrophy of anal folds which had previously been the seat of some persistent irritation. They are not infrequently secondary to some chronic disorder higher up the bowel, such as stricture or ulceration. Such tags and folds look innocent enough when in a quiescent state, but when inflamed they swell up, assuming an angry and formidable aspect.

Treatment of external piles.—This is generally a very simple matter, seldom demanding operative interference, which should be avoided if possible. Wounds in the muco-cutaneous surface do not heal so readily as on the mucous membrane, and are apt to degenerate into an ulcer difficult to cure. The thrombotic pile will generally disappear without causing trouble if the bowels be kept gently opened, and the parts made supple by the application of a simple ointment (ten grains of calomel to the ounce of vaseline). If, however, the swelling becomes very painful, and the part inflamed, immediate relief can be given by transfixing the little tumour with a sharp knife, and enucleating the contained clot, the part being subsequently treated with a warm poultice. The œdematous pile can be quickly cured by keeping the motion soft for a few days, by prescribing a teaspoonful of equal parts of confection of senna and confection of black pepper. Half a tumbler of Friedrichshall the first thing in the morning is another remedy, or a teaspoonful of compound liquorice powder may be substituted. The local treatment consists in bathing the part well night and morning with lukewarm water, after which an ointment should be applied. The unguentum hydrarg. ox. rub., diluted with equal parts of vaseline, is a good application, or the subsulphate of iron ointment (gr. x to ℥j) may be employed. The third variety of external pile, so long as they cause little trouble, had better be left alone; if, however, they are painful, or liable to become inflamed, they ought to be removed. This should always be done with the knife or scissors, and not with the ligature, and requires some care in its performance, for if too much skin be removed the subsequent contraction of the cicatrix may produce stricture. If the excrescences are at all pedunculated they may be completely cut off. Otherwise, half or two-thirds of each prominent projection is quite sufficient to remove, for the cicatrisation of the wound obliterates the remainder.

If external piles be complicated with internal, the former may be snipped off at the same time that the latter are tied.

INTERNAL HÆMORRHOIDS.

Internal piles result from a morbid condition of the blood-vessels terminating in and beneath the mucous coat. The terminal venous plexus is normally situated just within the anus immediately above the junction of the mucous membrane with the skin. In hæmorrhoidal disease, especially if of long standing, the dilated plexus may extend considerably higher up the mucous membrane, which in itself has a tendency to prolapse. (*See* Fig. 28.)

The causes giving rise to disease of the plexus are various, but they turn on the conditions leading to abnormal intravenous pressure. Veins thus affected undergo both increase in length and in calibre, while from the same cause minute vessels, or even capillaries, develop into thin-walled vessels or cavernous spaces. There is also a tendency in time for the arteries to share in the enlargement.

Obstruction of the circulation either through the heart, lungs, or liver, will cause increased pressure. Thus, the veins of the rectum frequently become hæmorrhoidal in cirrhosis of the liver or in thoracic disease. A constantly overloaded colon, abdominal tumours, or a gravid uterus, may lead to hæmorrhoidal trouble. Besides such passive causes, the rectal plexus may become dilated by the action of the abdominal muscles. This dilatation can be readily demonstrated by telling a patient to strain while piles are prolapsed, when they can be at once seen to swell up from venous engorgement. In a healthy rectum, undue dilatation is prevented by the action of the sphincter muscles; but if these be weak there is nothing to counteract the dilating force, which, if frequently applied, will ultimately cause varicosity of the veins. A ready explanation is thus afforded why piles so often complicate enlarged prostate, stricture of the urethra, phimosis, etc.; and above all it will be understood how prolonged and constant straining at stool may become a cause of hæmorrhoidal disorder.

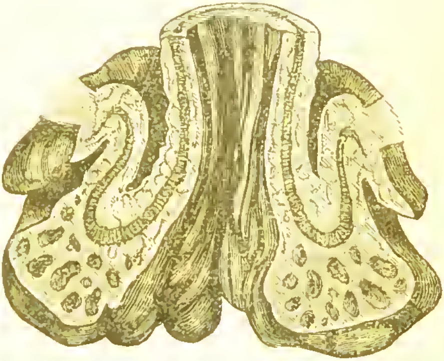


Fig. 28.—Internal Piles with Prolapse of the Mucous Membrane.

Two varieties of internal piles may be recognised, the *capillary* and the *venous*. The former consists of a vascular area of small vessels situated superficially in the mucous membrane, the latter of several large veins seated in the submucous tissue. In long-standing cases, and as the result of repeated inflammations, the disease is something more than a mere dilatation of the vessels, for partly by the remains of obliterated veins, the thickening of the walls of others, and the hypertrophy of the intervening fibrous tissue, tumours are formed containing a considerable quantity of solid material.

Symptoms.—The chief trouble from internal piles arises either from their tendency to prolapse, their liability to inflame, or the loss of blood they occasion.

Prolapse occurs in old-standing cases, especially when the piles are large from interstitial growth. In these cases, besides the actual hæmorrhoidal tumours, there is considerable prolapse of the mucous membrane. There is also a loss of power by the sphincter. The protrusion of the pile takes place at the time of a motion, and if only limited in extent can be voluntarily drawn up by the patient; but it sometimes happens that, owing to the amount of prolapse and the action of the sphincter, the protrusion requires to be replaced by the patient's fingers. The annoyance is often aggravated by the liability of the protrusion to occur out of season, an accident that may happen from some slight effort at an unguarded moment. If the protrusion is not quickly returned, the piles are apt to become partially strangulated by the sphincter, and the protruded part soon becoming swollen and œdematous, is liable to be chafed by the clothing.

Inflammation.—At these times the piles become swollen, and protrude not only in the cavity, but even through the external sphincter. When the swelling first takes place within the bowel it produces a feeling of pain and discomfort, as if an imperfectly passed motion or foreign body were present. Straining is induced, and the piles are extruded. Thus, piles which, when uninflamed, remain within the bowel causing little trouble, will from inflammation form a large mass about the anus.

Bleeding.—When straining at stool, or even from the irritation of a motion, bleeding commences, it may be so slight as to be scarcely noticeable, or sufficient to cause a dripping for several minutes, while occasionally it escapes in little jets, sprinkling the pan with minute drops. Loss of blood, if only occasional and limited in amount, causes no harm, but if persistent it becomes a source of ill-health. In some cases the effects may be more obviously disastrous. The patient's complexion becomes tallowy and the lips blanched, while there is breathlessness and palpitation on the slightest exertion; if allowed to continue the anæmia may become so extreme as to threaten life.

Diagnosis.—In order to establish this, an examination is necessary. On making this there is no difficulty in recognising the disorder, should the piles actually be down at the time of observation; but it often happens that there is no protrusion to be seen. It might seem a simple matter to pass the finger within the bowel, and to ascertain whether hæmorrhoidal swellings were present, yet, without considerable experience, it is not possible to recognise internal piles by the touch alone. The chief bulk of an internal hæmorrhoidal tumour is composed of dilated veins, which, whilst within the bowel, are comparatively collapsed and empty, only assuming the form of distinct tumours on protrusion from the anus, when they become engorged with blood.

In order to bring the piles into view, an injection should be given and passed away, and then the patient, lying on his left side, with the right knee well drawn up, must be told to strain downwards, as if about to pass a motion. At the same time the surgeon should gently draw upon the margin of the anus with the tips of the fingers, and then by degrees, if prolapse or internal hæmorrhoids be present, sufficient protrusion can be obtained to establish the diagnosis. As the internal pile gradually comes into view it will have a bright polished appearance, its surface being irregular, or dimpled like a mulberry. Its colour will vary from a red to a dark purple.

If an examination be made when internal piles are strangulated or acutely inflamed, the anus will be found surrounded by a considerable protrusion, which may involve part or the whole circumference of the bowel. In the latter case the swollen mass will be divided by three or four deep sulci. The swelling consists of the piles and prolapsed mucous membrane. The inner part of the fold is of a deep chocolate colour. The outer portion, as it merges towards the skin, is lighter in appearance. If the piles be subjected to the friction of the clothes, they will have a rough and excoriated surface, exuding a blood-stained serum. If left unrelieved, after days of suffering a large part of the mass may become black and pass into a state of gangrene.

Palliative treatment of internal piles.—Many slight cases of piles can be effectually cured without the necessity of operative interference. Such treatment, to be effectual, requires perseverance, and has often to be prolonged over a period reckoned by weeks or months rather than by days. Regular habits as to exercise and meals must be enforced, many an attack of inflammation being traced to over-indulgence in alcohol or indiscretions in diet.

The bowels should be carefully regulated, constipation and hard motions often exciting an attack. The following prescriptions are useful: Conf. sennæ ℥iss, sulph. precip. ʒss, mel. rosæ q. s.; about a teaspoonful every night.

The confection of black pepper has long enjoyed a reputation for curing piles, and may be thus prescribed: Conf. sennæ, conf. pip. nig. āā ℥j. A large teaspoonful the first thing in the morning.

In gouty patients, the Friedrichshall water is very useful, the dose being a wine-glass to half a tumbler, in a little warm water, the first thing in the morning. The compound liquorice powder is another favourite remedy, especially if combined with a small quantity of potash: Pot. bicarb. ʒj, fol. sennæ ʒiij, rad. glycyrrhizæ iij, pulv. fruct. fœniculi ʒiss, sulph. sub. ʒiss, pulv. sacch. ʒix. About a teaspoonful, in a wine-glassful of milk in the morning.

In prescribing local applications, they should at first be sufficiently mild not to cause pain. In old cases, where there is much relapse, local applications are of little service; but when the piles are vascular, and hæmorrhage the chief symptom, astringent ointments are of great value. Such applications appear to owe their efficacy to the thickening or hardening they produce on the vascular area. It is of no use merely to smear the anal outlet with the ointment, for to be effectual it must be applied to the mucous surface within the sphincter. This can be accomplished, either by the patient passing the ointment in with the finger, or by an ointment introducer. The subsulphate of iron forms a valuable ointment, and may be prescribed from five to thirty grains to the ounce of vaseline. Tannic acid in the proportion of one drachm to the ounce is a good hæmostatic. The compound gall ointment is another well-tried remedy, but it is better to commence with it only half the pharmacopœial strength.

Cold water injections may be beneficial, especially if there be much prolapse. The patient should throw up three-quarters of a pint of tepid water every morning, with a view of bringing the motions regularly away. Then, after the motion, two ounces of quite cold water is injected, which can either be retained or passed out in a few minutes.

Treatment of inflamed piles. — If the inflammation be slight, a dose of castor oil may be prescribed, while half an ounce of thin warm starch, to which twenty drops of liquor opii have been added, may be gently injected up the bowel, or a suppository containing a quarter of a grain of morphia may be substituted. If the inflammation be more considerable, hot fomentations are very soothing, especially when pressed firmly against the part. The patient must be kept recumbent, so as to relieve the intravenous pressure. The question may arise as to whether inflamed piles should be operated upon. This has often been done without harm arising, but as a rule it will be more prudent to defer interference until the parts have quieted down.

Treatment of strangulated piles.—Under an anæsthetic, the protrusion must be returned within the sphincter. This can generally be accomplished by gentle continuous pressure with the finger-tips. If necessary, the sphincter may be stretched to effect the reduction. The continuous pressure of a soft sponge will prevent the parts from again prolapsing. If the piles have actually become gangrenous, they should not be reduced, but a charcoal poultice should be applied, and the patient should be kept absolutely at rest, until the slough separates.

Operative treatment of internal piles.—When piles become troublesome and detrimental to health, either from their tendency to prolapse or bleed, and after palliative treatment has failed, an operation can be strongly recommended in the majority of cases, as affording a complete and permanent cure. Piles should not, however, be operated upon when they are the result of some other disorder higher up the bowel, such as stricture, cancer, disease of the uterus, or bladder, enlarged prostate, cirrhosis of the liver, or thoracic disease. The hæmorrhoids so commonly occurring during pregnancy should not be operated upon, unless necessary to arrest severe hæmorrhage. If care be taken to ascertain that there is no renal disease, the risk of the operation is extremely small, compared to the benefit obtained. Of the many means devised for removing piles, the following may be enumerated: 1. Nitric acid. 2. Injection of carbolic acid. 3. Crushing. 4. Puncture with hot needles. 5. Clamp and cautery. 6. Ligature. Of these methods I regard the ligature or the injection of carbolic acid as the most trustworthy.

Nitric acid is useful in slight cases, especially where the trouble consists of hæmorrhage from a superficial vascular area. It is best to have the patient under an anæsthetic, and the sphincter dilated. The vascular spot is then exposed by a speculum, its surface dried by a piece of blotting-paper, and painted over by fuming nitric acid. Allowing this to remain for a few seconds, it may then be washed by a solution of carbonate of soda, a little vaseline being applied ; the whole is then returned within the bowel. The patient must be confined to his room for a few days. The cure is effected, partly by the actual destruction of the superficial vessels by the acid, and partly by the consolidation and contraction of the remainder by inflammation.

Injection of carbolic acid.—This is an excellent method in many cases, for the patient need not necessarily lie up, but the treatment takes many weeks. The best strength for use is thirty grains of the acid, dissolved in glycerine and water, a drachm of each. The piles being drawn down, four minims of the mixture should be injected, by a hypodermic syringe, into the centre of each pile. It is important that the needle should be thrust well into the centre, for if the acid be injected beneath the mucous membrane only, it will slough, and an ulcer result. The injections may require to be repeated on several occasions, and the patient should be kept in the recumbent position for a few hours following the treatment. As a rule, very little pain follows the injection.

Puncture by hot needles.—The operation is performed by inserting a large heated needle into the pile, in several different places.

Crushing.—The piles being drawn down, the base of each is separately grasped by some specially devised forceps, and by means of a screw acting on the blades, the included portion is slowly crushed.

Clamp and cautery.—The pile or prolapsed part is seized by the vulsellum forceps, and drawn well down. A clamp, specially devised by Mr. Henry Smith, is tightly applied to the base. The mucous membrane and pile beyond the grasp of the clamp are cut off by scissors, and the raw edge is touched with the cautery.

Ligature.—The patient, under an anæsthetic, is placed in the lithotomy position. The sphincter must next be thoroughly dilated. The most prominent pile is first seized with forceps. The mucous membrane and pile are then detached from the anal margin by cutting with scissors just through the junction of the mucous membrane with the skin, while by a few slight snips the detached portion can be dissected off the submucous coat for a short distance. A deep groove is thus formed. A strong silk ligature, previously soaked in carbolic lotion, is tied firmly round the undetached root of the pile, care being taken to manipulate the loop as high up the mucous membrane as possible before tightening it. When piles are numerous, several ligatures are required. The ends should be cut off short, and the whole returned within the sphincter. A good pad of cotton wool, kept in position by a perineal bandage, is all the dressing required. If no skin has been included in the ligature, there is not much pain. A full dose of opium should be given at night with a view to keeping the bowels at rest. The ligatures separate between the fifth and eighth day. On the fifth day, if not previously opened, the bowels should be relieved by a dose of castor oil. The patient should be kept for a week or ten days in bed or on a sofa. If the case be complicated with external piles, some of the more prominent folds may be snipped off; but, as a rule, if the external piles are only slight they should be left alone, for they will generally disappear spontaneously after the cure of the internal hæmorrhoids.

Hæmorrhage after pile operations.—This very rarely follows the use of the ligature. Should recurrent oozing be troublesome, it may be stopped by a little tightening of the perineal compress, or, failing this, the clot that collects about the anus may be gently syringed away with a little cold water, and the compress reapplied. Secondary hæmorrhage is more serious; the effect of thoroughly syringing the part with cold water, and the careful application of a compress, may be tried; should this fail the rectum must be plugged. The inflation of a properly constructed indiarubber bag is a good plan, but if this is not at hand, a hollow tube, such as the nozzle of a female douche syringe, should be passed into the bowel, after which cotton wool, sprinkled with subsulphate of iron powder, may be very carefully and firmly plugged around it.

PROLAPSE.

This is the descent of a portion of the bowel in a healthy state, and must not be confused with the prolapse which sometimes complicates piles. Prolapse is called partial when the mucous membrane alone is involved. It is called complete when affecting all the coats. The mucous coat is normally but loosely attached to the muscular coat, and the submucous tissue between the two may become so yielding as to admit of the mucous coat sliding for an inch or more on the external coats. Partial prolapse is of a limited extent. In complete prolapse any length of the bowel may be involved. The disorder is most common in children or in advanced life. It is generally the result of undue straining, though occasionally caused by polypoid growths. In children, stone in the bladder, phimosis, or straining from constipation, may be frequently noted as the cause of prolapse.

Diagnosis.—When the prolapse is actually down, it is easily recognised, but a little care may be necessary not to mistake it for polypus or piles. From the former it may be distinguished by its softer feel, uniformly smooth surface, and above all, by the absence of a pedicle; while the uniform smooth rolls of bright red membrane in prolapse are distinguishable from the bunched arrangement of piles.

Treatment.—This must be considered, first, as regards the reduction of the bowel when prolapsed or strangulated; and secondly, as to the remedies required to prevent its recurrence. In a child the buttocks should be raised by laying it across its mother's knee. The protruded part, being covered with vaseline, should be evenly pressed with the tips of the fingers. If but recently come down, a few seconds' pressure will serve for reduction. If the protrusion has become swollen it is not so easy, but firm pressure for five or ten minutes with a soft sponge generally succeeds. If this fails, the index finger being lightly wrapped round with a piece of lint, the tip is introduced into the protruded canal pressing it gently upwards. The lint, being dry, will stick to the membrane, and after the reduction the finger can be withdrawn, leaving the lint inside.

All manipulation should be very gentle, or laceration of the bowel may occur.

To prevent recurrence the patient should on no account be allowed to pass a motion in the sitting posture, but should do so lying on the side, and if the anus be drawn by the fingers a little to one side as the motion is passing, it will generally prevent the descent of the bowel. After the motion it is a good plan, in children, to forcibly compress the nates together by a piece of strapping laid transversely across them. A teaspoonful of cod-liver oil three times a day may be given to children, which, besides its nutritive effects, tends to soften the motion. By persistence in this line of treatment for a few months the tendency to prolapse may often disappear, provided any obvious cause such as phimosis, etc., be removed.

In the adult careful regulation of the bowels, and astringent ointments, such as gall ointment or tannic acid, half a drachm to the ounce, may prevent the prolapse becoming troublesome. Should an operation become necessary, in slight cases portions of the protrusion may be removed by a cautery or ligature. In more extensive cases the plan of artificially exciting inflammation between the muscular and mucous coats, so as to bind them more firmly to each other, is often effectual. A large speculum being introduced into the rectum, four lines of cautery, three to four inches in length, and an equal distance apart, are drawn along the bowel in its long axis, terminating at the anus. A small cautery iron, with the bulb bent at a right angle, and at a black heat, is the most convenient form of cautery to employ. The bowels should be kept confined for a week, and great care taken when they are moved, by position and pressure, to prevent the prolapse from recurring.

RECTAL ABSCESS.

There are four situations in which matter forms in the neighbourhood of the rectum:

1. Marginal abscess, situated in one of the cutaneous folds of the anus.
2. Ischio-rectal abscess, situated in the fossa.
3. Intermural abscess, situated in the bowel, between the mucous and muscular coats.
4. The perirectal abscess, formed in the pelvis around the rectum.

In the majority of cases the abscesses are traumatic, that is, secondary to some slight puncture or injury inflicted by a fish bone, husk, or other foreign body, during its passage. Abscess is very liable to form from slight causes in debilitated patients, especially when suffering from tubercular disease. Abscesses may be acute, forming in a few days; or subacute, lasting over weeks.

Symptoms and diagnosis.—The symptoms generally commence with a sharp pricking sensation, soon followed by an aching throbbing pain. As the abscess progresses the pain increases, often becoming very acute. If the abscess be in the ischio-rectal fossa, a hard swelling will be felt over the neighbourhood. As the pus advances towards the surface, the skin becomes red and fluctuation can be detected.

The intermural abscess and perirectal abscess cause much less pain than the other two varieties, and are very apt, therefore, to be overlooked till they burst into the bowel, suddenly discharging a quantity of pus. A sense of weight and uneasiness, combined with some signs of obstruction, are often the only symptoms complained of; but when the finger is introduced, fluctuating swelling can easily be detected. The perirectal abscess is often chronic, and sometimes complicates a rectal stricture. If undetected it is always dangerous. I have recorded three fatal cases occurring at St. Bartholomew's; in two, sudden death resulted from the bursting of the abscess into the peritoneal cavity, in the third it caused fatal obstruction.

Treatment.—Rectal abscesses should be opened as early as possible, for if left to burst of themselves the skin becomes undermined and extensive fistulæ may result.

In opening the abscess, owing to the exquisite tenderness of the part, and the importance of making the incision freely, an anæsthetic should be administered. A free opening should then be made through the skin over the most prominent part of the swelling, and after the matter has been let out a drainage tube should be introduced. If great care be taken, both with the subsequent drainage and keeping the external orifice open, the part may heal without the formation of a fistula.

Gangrenous inflammation about the rectum.—In those who have spoilt their tissues by prolonged indulgence in drink, phlegmonous inflammation may attack the parts around the rectum, and the inflammation may run on to sloughing, or even gangrene of the skin and subcutaneous tissue. Sometimes, from this form of diffuse cellulitis, the rectum is left almost isolated by the destruction of the surrounding tissue. These cases are dangerous. The patient's strength must be supported by beef essence and other forms of concentrated foods. The part should be covered by a warm charcoal poultice, and cold should on no account be applied.

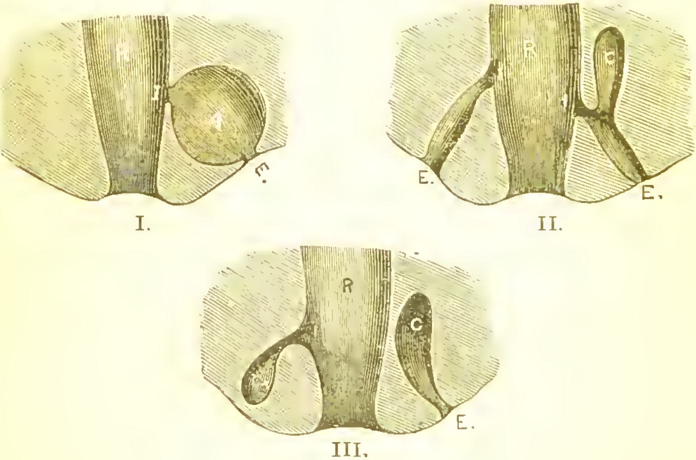
FISTULA IN ANO.

Fistula results from an abscess which has broken, while the walls have shrunk into a tubular channel. Two chief causes may be mentioned why rectal abscesses should so commonly degenerate into fistulæ: the one is, that owing to an internal opening within the bowel small particles of fæcal material are constantly finding their way into the sinus, preventing healing; the other is, that owing to the frequent movements of the part by the sphincter muscle, sufficient rest is not obtained for the completion of the reparative process.

Fistulæ are divided into three varieties:

1. Complete fistula.
2. Blind external fistula.
3. Blind internal fistula.

Complete fistula.—This is the commonest form of fistula. The sinus extends from an opening through the skin external to the anus, to an internal opening through the mucous membrane within the bowel (Fig. 29 ; I). The internal opening is not always easy to find, but its discovery is a matter of considerable importance in treatment. The difficulty arises from the internal opening not always being situated at the apex of the sinus, but much nearer the anus.



I. II. III.

Fig. 29.—Diagrams showing the Varieties and Formation of Fistula.

I. R, Rectum ; A, abscess breaking both into the rectum at I and through the skin at E.
II. On the right side is shown the abscess cavity contracted, and the method of formation of the cul-de-sac at C, extending above the internal opening, I, is seen. On the left side is a complete fistula without any cul-de-sac.
III. R, Rectum ; C I, blind internal fistula ; C E, blind external fistula.

The accompanying diagram will help to explain this. Fig. 29 I represents an abscess in the ischio-rectal fossa, the pus from which is making its way along the lines of least resistance, which is generally outwards towards the surface of the skin over the fossa, and inwards towards the cavity of the bowel between the sphincter muscles. The abscess will first break at one of these points only, but the tissue becomes so thinned at the other that it will subsequently give way by ulceration. A probe passed into the external opening will have to traverse a portion of the abscess cavity before finding its way into the bowel. If the abscess cavity, as sometimes happens, is shrunk to a mere channel, at either end of which are the openings (Fig. 29; II), there is no difficulty in passing a probe through; but since the abscess does not generally break at its highest point, but by a hole through its side, when the pus is evacuated and the cavity contracts a cul-de-sac will be formed, running considerably higher than the internal opening (Fig. 29; II, C). It is into this cul-de-sac that the probe so easily passes, the internal opening being in reality situated much nearer the anus.

In examining a case of suspected fistula the external orifice can generally be at once seen. Sometimes it is very small, and requires some search to find it. By carefully feeling all round the anal margin, a cord-like induration may often be found, which points to the site of the fistula. A probe should be gently passed along the sinus, and subsequently the finger should be introduced into the rectum to feel for the probe or internal opening. No force must be used, for it is easy to make a sinus where none previously existed. In neglected cases of fistula there may be more than one channel, for, owing to the retention of matter and the formation of secondary abscess, the parts in the neighbourhood of the anus may become riddled with sinuses; but, however numerous these may be, they seldom communicate with the bowel, except by a single internal opening. Sometimes the fistula runs partly round the bowel, the internal opening being on the opposite side to the external.

There is always some slight weeping or discharge unless the opening be blocked. At such times a little extra pain and swelling will occur from the collection of retained matter. Then the discharge suddenly breaks out again in increased quantity, the swelling and tenderness simultaneously disappearing. The amount of discharge from a fistula varies greatly. In some cases it is only just sufficient to stain the linen; while, if the disease be more extensive, it may be so profuse as to keep the patient constantly wet. The discharge also varies at different times. For months there may be no pain, and very little discharge. Then, somewhat suddenly, the fistula will become painful, the part feeling hard and swollen. This indicates an increased inflammatory action, to be followed by a fresh abscess, or a more copious secretion.

Blind external fistula.—In this variety there is an external opening through the skin, but no communication with the bowel, the original abscess having either never broken into the bowel, or, if so, the opening has become closed. Occasionally this form of fistula results from an external wound (Fig. 29 : III).

Blind internal fistula.—In this form of fistula the abscess has broken into the bowel only, so that there is no external opening (Fig. 29 ; III). The symptoms of these fistulæ are somewhat obscure, and the disease is therefore liable to be overlooked. There is a certain amount of discharge from the anus, while a sense of discomfort and occasional pain is experienced. Sometimes there is a very characteristic feature in these cases. The patient will notice from time to time a hard tender swelling in the anal neighbourhood, which will be followed in a day or two by a discharge of pus from the bowel, the external swelling at the same time diminishing. Upon introducing the finger into the bowel, a ragged, irregular spot sometimes points to the internal opening. On exposing the part with a speculum, it may be ascertained with a probe that the mucous membrane in the neighbourhood of the opening is much undermined.

Treatment of fistula in ano.—A fistula if left to itself may go on for years without causing trouble, but this is exceptional, and more generally it has a tendency to get worse, undermining and spoiling the tissues, and even giving rise to stricture. It is desirable, therefore, that it should be cured as soon as possible.

It is just possible that a cure may be effected by paying great attention to drainage, by keeping the external opening free, while an attempt is made to excite healthy action in the fistula itself by the passage of a probe on which a little nitrate of silver has been fused. In the majority of cases the best treatment is to lay the sinus freely open, and allow it to heal from the bottom. There are some exceptions to this rule. Severe organic disease, such as albuminuria, diabetes, alcoholism, are conditions which add risk to an otherwise safe operation. Phthisis is not an absolute bar to the operation, but, if the lung mischief be active, it is better that no operation be performed. On the other hand it may be desirable, if the fistula be troublesome and the lung mischief be in abeyance, to operate. As regards local conditions, it must be remembered how frequently fistula complicates rectal cancer and stricture, in which circumstances operative treatment must be directed towards the primary disease.

Method of operating.—The patient being placed in the lithotomy position, a director should be passed through the fistula into the bowel. The left fore-finger introduced into the rectum feels the point of the director. It is very desirable, if possible, that the director should be passed through the internal opening into the bowel; but if, after a careful manipulation, the internal opening cannot be found, the director must be pushed through the thin mucous membrane into the bowel. If the internal opening be in the usual situation, close to the anus, the point of the director, if a little bent, may be brought out of the bowel. The intervening parts are then divided by running a sharp-pointed curved bistoury along the groove. If the internal opening be so high that the end of the director cannot be conveniently turned out at the anus, the intervening tissues may be divided by a strong pair of straight scissors.

When the main channel has been laid open, examination should be made with the director to ascertain if a blind tract runs farther up the bowel. If it does so, it must be divided with scissors. Search should also be made to see if a lateral sinus exists. In doing this it must be borne in mind that a probe passes so easily along the loose connective tissue that it may readily make a channel where none previously existed. The operation should be completed by cutting away freely any overhanging borders of skin. The sphincter should never be divided in two places, and in women a fistula should not be cut if it runs beneath the sphincter muscle along the anterior wall. The double division of the sphincter may lead to incontinence, while in the female cutting the muscle, as it decussates with the vaginal fibres, will almost certainly do so. The treatment after an operation for fistula is of as much importance as the operation itself. If the discharge does not drain freely, the edges of the wound become undermined, and secondary channels will form. Another trouble is the tendency for the granulations at the verge of the anus to bridge over and adhere, leaving an unobliterated channel below. To avoid these troubles a single piece of oiled lint should be gently introduced daily between the cut edges of the wound. Should the superficial granulations become accidentally adherent, they will readily give way if a probe be lightly run over them. The bowels may be opened on the fifth day by castor oil. In an average case the patient must be kept in bed a fortnight, and confined to his room for another couple of weeks.

Treatment by elastic ligature.—Occasionally, when the nervous condition of the patient renders a cutting operation unadvisable, this method may be employed. A solid cord of red indiarubber a tenth of an inch in diameter may be threaded through the eye of a silver probe, which, followed by the thread, is passed through the fistula from the external to the internal opening, and out through the anus. As the cord is passed through, to facilitate its passage it should be put on the stretch. Over the two ends of the cord is slipped a leaden ring, the cord is then tightly stretched, and the ring slipped up as high as possible and clamped. If the internal opening be any distance up the bowel, Allingham's instrument facilitates the passage of the ligature. The objection to the plan of operating with the ligature is that it deals only with the main channel, and therefore would not cure a case in which lateral diverticulæ existed.

ANAL ULCER OR FISSURE.

The true anal ulcer is of peculiar interest to surgeons, for, while the symptoms to which it gives rise are especially distressing, they admit of complete relief by the simplest measures. The disease must not be confused with the extensive and intractable ulceration to which the mucous membrane in the lower part of the bowel is liable, nor is it identical with the ragged syphilitic ulceration found at the anal margin. It is a strictly local disorder, and may occur in those whose general health is perfectly sound. It appears commonly to commence from some crack, caused by a constipated motion, which refuses to heal owing to the constant movement of the sphincter, gradually assuming the characteristics of anal ulcer. It is not uncommon, however, to observe that the difficulty of healing depends on something more than mere movement, and to find that a small polypus or a tag of hypertrophied mucous membrane situated just above the ulcer, or a little fistula running from the ulcerated margin, prevents the healing.

Symptoms.—When one of these ulcers is thoroughly established the symptoms are peculiar and distinctive. There is suffering out of all proportion to the extent of the lesion. The patient complains, either immediately or within a few minutes of passing a motion, of a hot, smarting pain about the rectum, radiating upwards towards the sacrum and coccyx. The pain, at first smarting, gradually assumes a dull aching character, which, after a while, passes completely away, only to be repeated at the next evacuation. In some instances the pain only lasts a few minutes; in others it will be half the day before it disappears. There may be a little bleeding after the motion, and there is very commonly a slight anal discharge. These ulcers occur far more frequently in women than in men, and it is by no means uncommon for the sufferer to refer the pain to the vagina or womb, and thus cases may be long treated as a uterine affection when the symptoms are really due to an anal ulcer. The suspicion of an anal ulcer may be very generally verified by examination. Its common situation is posteriorly, the position being often indicated by two slightly red and œdematous anal folds, which might be mistaken for external piles, but on carefully separating these with the fingers the lower border of the ulcer will be found. Its character is not constant. Sometimes it is quite superficial; at others it has extended deeply, exposing the subjacent muscular fibres. The ulcer is seldom larger than a threepenny piece, while at times it is so small as only to be detected after a careful search.

If the symptoms have existed any length of time there is some spasm of the sphincter muscle and of the levatores ani, and any attempt to pass the finger into the bowel is extremely painful. If the subjective symptoms of fissure be well marked and if there be spasmodic contraction of the anus, notwithstanding that nothing can be seen at the margin, a thorough examination should be made under an anæsthetic before the patient can be pronounced free from the disease.

Treatment.—If of recent origin, there is a fair prospect of cure without operative procedure. In such cases a soft motion should be obtained every morning for a fortnight, so as to prevent the surface being roughly torn by a constipated action. In hospital practice two large teaspoonfuls of equal parts of confection of senna and confection of black pepper may be taken the first thing in the morning. In private practice a third of a tumbler of Friedrichshall to be taken with a little warm water on first waking in the morning, or two to four grains of the extract of cascara sagrada, to be taken as a pill at night, may be tried. The parts should be very carefully washed with a soft sponge after each motion. As a local application the unguentum hydrarg. oxidi rubri is useful, or the ferri subsulph. gr. x, unguentum petrolii ℥i. If these simple remedies fail, the ulcer can be certainly cured by partial division of the sphincter. This is accomplished by exposing the ulcer with a speculum, a knife being drawn across its surface so as to divide about a third of the fibres of the external sphincter. Simple dilatation of the sphincter is not always successful. The ulcer is sometimes cured by being touched with nitrate of silver or the actual cautery, but the proceeding is exquisitely painful, and should only be done under an anæsthetic. When failure occurs after attempts to cure an anal ulcer, it will generally be found that some complication has been overlooked, such as a fistulous passage running from the ulcer, or a polypoid growth situated at its base.

ULCERATION OF ANUS AND RECTUM.

Besides the typical anal ulcer just described, there are other forms of ulceration of the rectum and anus. Many owe their origin to a syphilitic or tubercular diathesis, while others result from the part being badly nourished either from local or general causes.

Syphilitic ulceration.—Syphilitic ulceration about the anus generally appears from three months to a year after infection. It is usually confined to the anal margin. The more extensive ulcerations higher up the bowel are met with at a later period of the disease, and probably result from the breaking down of the tertiary gummata. Syphilitic ulcers are often multiple. Sometimes several fissure-like cracks exist between the anal folds. These folds have a whitish, slightly sodden appearance, the whole part being moistened by a thin fœtid secretion.

Congenital syphilitic ulceration.—This is a common affection in infancy, but, according to my experience, it seldom occurs until three or four months after birth. The anus is surrounded by a dull copper-coloured zone, half an inch or more in width. This zone near the anal margin has a coarse granular appearance, the surface being raw and bathed with a moist secretion. On separating the anal margins some fissures may be seen extending a short distance into the bowel. The infant is fretful and generally wasted, while other specific manifestations are probably present.

Tubercular ulceration.—This may take the form of extensive ulceration, commencing at the anus and spreading upwards, but more frequently it begins at several points about the rectum, resembling the folicular ulceration observed in other parts of the intestine. It occasionally commences as an intermural abscess. Other symptoms of phthisis are usually present.

Ulceration in Bright's disease.—An ulceration of the rectum of a superficial nature, but extending over a large area of the bowel, is sometimes observed in advanced cases of albuminuria.

Senile ulceration is occasionally noticed about the bowel in old people, which seems to be the result of chronic venous congestion, and is probably analogous to the varicose ulceration of the legs.

A form of ulceration is found about the anus consisting of small shallow excavations, often multiple. They are specially liable to form in women who suffer from leucorrhœa or other vaginal discharge. At times they produce swelling and œdema of the neighbouring skin, which in chronic cases may end in permanent hypertrophy of the anal folds.

Symptoms.—The symptoms of rectal ulceration are often mistaken for dysentery. Pain, tenesmus, diarrhœa, and discharge are present. The amount of pain is no indication of the severity of the disease, and depends more on the situation than on the extent of the ulceration, the smallest fissure near the anal margin causing more suffering than an extensive ulceration higher up the bowel. There is a frequent desire to go to the closet, but, instead of a proper motion, only a few teaspoonfuls of discharge come away. The discharge at first may be of a mucoid character, resembling a mixture of sago and yeast. Later, the discharge generally becomes darker, having a "coffee-ground" appearance. Control over the sphincter may be partly lost. As the ulceration heals in places, cicatricial tissue is irregularly produced, and the bowel, losing its normal supple feel, becomes hard and rough, while a certain amount of tubular stricture is produced. A speculum is of great service in confirming the diagnosis.

Treatment.—Syphilitic ulcerations, while still confined to the anal margin, are usually curable without operation. The part must be kept extremely clean, being washed twice a day with soft warm water, and then well bathed with lotio nigra. After it has been thoroughly dried the part may be sprinkled with the following powder: Pulv. hydrarg. subchlor. gr. xx; pulv. zinci ox. ʒss; pulv. amyli ʒij. If the discharge be very fœtid gr. xx of iodoform powder may be added. The old powder must be carefully washed off before fresh is applied. General antisyphilitic treatment must be at the same time adopted.

If a tubercular origin of the disease be suspected, appropriate constitutional treatment must be tried. In some obstinate cases of ulceration it is worth while to try for a time an absolutely milk diet. Cod-liver oil is often beneficial, while if there be much reflex irritability of the bowel the following prescription may be tried: Liq. opii ʒj; liq. bismuthi ℥iij; tinct. catechu ʒj; mist. cretæ ad ℥vj; dose, a tablespoonful three times a day. The local treatment is important. The patient should be kept as much as possible in the recumbent position, which prevents congestion and does much to promote healing. Night and morning the bowel may be gently washed out with warm water, to which half an ounce of boroglyceride has been added to the pint. After the evening washing an ounce of warm thin starch, containing twenty drops of laudanum, injected well up the bowel with a soft tube, gives much relief. A simple, unirritating ointment made with ten grains of calomel to the ounce of vaseline may be applied twice a day by means of an ointment introducer.

If the ulceration be situated low down in the rectum, and the sphincter muscle be strong and irritable, and if the disease has resisted simpler methods of treatment, it may be divided. In severe cases, after the failure of other plans, colotomy may be performed.

STRICTURE OF THE RECTUM.

Strictures of the rectum may be classified as fibrous and malignant. The former alone is here considered. The pathological changes in the bowel consist of a thickening and blending together of the coats at the site of stricture. On section the cause of thickening is observed to be partly new fibrous tissue developed between the tunics of the bowel, and partly a great thickening of the fibrous trabeculæ of the muscular coats, while the muscular fibre itself has either partially or completely disappeared.

The mucous membrane both of the strictured part and that lying between it and the anus is often destroyed by ulceration, though by no means universally so. In a few rare cases of narrow annular stricture the contraction appears to be confined to the mucous and internal muscular coats only, taking the form of a permanently reduplicated fold of mucous membrane.

There are two pathological conditions in which I believe these fibrous strictures to originate: (1) chronic inflammation; (2) the tendency of muscular fibre, when subject to undue and persistent irritation, to undergo a fibroid degeneration, with permanent atrophic contraction of its fibrous element.

Chronic inflammation.—This leads to the production of new fibrous tissue, which, together with the old fibrous framework of the inflamed part, has a subsequent tendency to contraction. Remembering the circular arrangement of the fibrous tissue of the bowel, it can be readily understood how an inflammation affecting even a limited area of its circumference may, by drawing the circular fibres like a knot towards one point, produce a stricture of the canal. And, further, it can be seen how inflammations external to the bowel, such as pelvic cellulitis, may occasionally produce a similar result from the continuity of some of the rectal fibres with the pelvic fascia.

Muscular atrophic contraction.—That a temporary stricture can be produced by muscular spasm I have no doubt, for I have felt a marked contraction of the bowel slowly relax to the gentle pressure of the finger if continued for some minutes, and the finger palpably grasped again on moving it roughly. The spasm appears to be reflex from the irritation caused by the touching of an ulcerated or tender mucous membrane, and either affects the circular muscular fibres of the bowel or the levatores ani external to it. Permanent spasm, either of voluntary or involuntary muscular fibre, is an impossibility, but the relationship between these spasmodic and permanent contractions can probably be explained by analogy. Take, for instance, a case of an untreated chronic disease of the knee joint, where it will be found that the hamstring muscles have dislocated the tibia from the femur. At first it can be shown by the startings of the limb and other evidence that the muscular spasm is a pure reflex action, but after a while the muscles thus irritated suffer an atrophy of their muscular fibre, and the subsequent contraction of their remaining fibrous tissue element renders the condition permanent.

It will be gathered from the foregoing remarks that any morbid processes giving rise to ulcerations or inflammations may terminate in stricture. Thus, ulcerations simple or syphilitic, pelvic inflammations following child-birth, dysentery, fistulæ, operations for piles, etc., may be reckoned amongst the causes of stricture. Syphilis, from its producing ulceration or chronic inflammation, not uncommonly precedes stricture, but there is no justification whatever in attributing, as is too frequently the case, the majority of fibrous strictures to this disease.

Fibrous strictures are conveniently divided into *annular* and *tubular*, according to the extent of bowel involved. There is no arbitrary division between the two. Any stricture involving less than an inch of the bowel should be described as annular, reserving the term tubular stricture for cases in which a greater length of the bowel is implicated. "Annular" strictures, if neglected, will gradually extend and thus become tubular.

Symptoms.—These vary widely according to the stage of the disorder. The amount of contraction may be so slight as to cause little trouble, or so tight as to lead to complete occlusion. Again, such complications as ulceration and inflammation materially alter the character of the disorder. The disease, too, is chronic with a tendency to get worse, so that symptoms develop at the later stage which are absent at the beginning. Stricture frequently following upon ulceration will often be preceded by symptoms of the latter disease. Owing to the insidious manner in which contraction commences, it has made considerable progress before the attention of the patient is attracted to the part. The first symptom may be a difficulty in passing the motions, attributed by the patient to constipation. This difficulty slowly increases, and relief is sought from purgative medicine. At this time the motions are noticed to be smaller than natural, being described as resembling pipe stems, or passed in small shapeless fragments. It must be borne in mind that ribbon-like motions are not necessarily due to stricture, for an irritable sphincter may produce a similar result. There is a feeling after going to closet as if the bowels had not been completely relieved, and women especially complain of a certain amount of "bearing down pain." As the disease advances, and probably coincident with some ulceration of the part, its character alters, all the symptoms increasing in severity. Diarrhœa alternates with constipation, the former becoming perhaps the more prominent symptom of the two. The diarrhœa is of a very teasing character, requiring the patient to visit the closet a dozen times a day or more. On these occasions only a little solid material is passed, with some teaspoonfuls of a yeasty-looking discharge. In more advanced cases the discharge is of a darker colour, somewhat resembling coffee-grounds. The desire for a motion seems quickly to follow taking anything to eat or drink. Wind is often a source of great trouble, and this the patient dare not expel except at stool, for the effort to do so is followed by a liquid discharge. At this time abscesses may form in the neighbourhood of the stricture, resulting in the formation of fistulæ. In women it is not uncommon for a recto-vaginal fistula to form, so that fæces are passed by the vagina.

The anus becomes excoriated and inflamed by the discharges, and around its margin may be seen œdematous folds of skin having a pink shiny appearance. Albumen is often found in the urine.

When affairs get to this condition the state of the patient is very distressing, much of the day being passed in ineffectual attempts to procure an evacuation; while the discharge, over which they have lost all control, is nearly constant. If unrelieved, there is an increasing tendency towards death, albumen appears in the urine, the patient becomes hectic and emaciated, and the scene not unfrequently closes with an acute attack of peritonitis or intestinal obstruction.

The foregoing is a sketch of the progress of a bad case of rectal stricture, the symptoms being mentioned in the sequence in which they generally occur. It must be borne in mind, however, that many of these symptoms are common to other diseases of the bowel besides stricture ; nevertheless, collectively they afford almost certain evidence of its presence. If the stricture be in the lower four inches of the bowel, the diagnosis can be established by digital examination On passing the finger through the anus there is often a marked absence of contractile power in the sphincter. The bowel below the stricture is seldom normal, and, instead of being soft, conveys a harsh creaking sensation to the finger. The mucous membrane may be irregular, sacculated in some places, and nodulated in others, and adherent to the subjacent tissues.

The strictured portion may commence abruptly, the finger tip passing into a narrow orifice in the centre of a kind of diaphragm, or the contraction may be more gradual, being cone-shaped with the base downwards. If the stricture be annular, the finger may pass through it ; but on the first examination it is not generally possible to do more than pass the tip of the finger into the stricture. Any attempt to forcibly pass the finger through a stricture is very dangerous.

It is certainly most desirable to know if the stricture be of a tubular or annular nature, and by means of a properly shaped acorn-headed sound this can be generally ascertained.

Stricture situated high up the rectum, and beyond the reach of the finger, is extremely difficult to diagnose. Obstinate constipation, alternating with diarrhœa and discharge, and other general symptoms, have to be relied upon. Occasionally, the careful use of a bougie may be of value; but, by catching against the promontory of the sacrum, or being arrested by a fold of mucous membrane, it is very liable to mislead. Fibrous stricture is far more common in women than in men.

Treatment.—Annular strictures can always be relieved, and sometimes cured, by local treatment; but many cases of tubular stricture are beyond the hope of local remedy.

The methods of treatment may be considered in the following order: (1) Gradual dilatation. (2) Internal division of the stricture. (3) Complete section of the stricture, with division of external parts. (4) Colotomy.

Forcible dilatation should never be tried. It is a proceeding fraught with the greatest danger.

Gradual dilatation.—The form of bougie I have found most useful for the purpose of dilatation is that made, by my suggestion, by Messrs. Arnold. They are six inches in length, of a slightly coniform shape, and of uniform taper from apex to base, and are supplied in twelve sizes.

Treatment should be commenced with such a size as will pass through the stricture with a moderate amount of pressure. It should be passed daily, and retained from five minutes to an hour or more, according to the strength of the patient to bear it. An advance can be made in the size every third or fourth day, always provided no pain is produced by this increase. The patient should be kept in bed, or, at least, in the recumbent position, during the first few weeks of treatment. By perseverance and taking care not to produce inflammatory trouble by too rapid stretching, in many cases, after a month or two, the patient will be greatly relieved. To prevent retraction the patient must be taught to pass the bougie for herself once or twice a week, as occasion may require.

Operative treatment. — Unfortunately it sometimes happens that but little progress can be made with bougies, or that, from ulceration and inflammation, the treatment has to be discontinued. In these circumstances the stricture must be divided. In the rare cases in which the stricture is confined to a mere narrow diaphragm of contracted mucous membrane, it will suffice to divide the obstructing band. Internal division is not to be recommended for more extensive cases. A deep cut would be necessary, and, owing to the retention of purulent discharge and fæcal matter in this wound, suppuration is excited and matter burrows, giving rise to troublesome, if not dangerous, complications. By far the best treatment is a linear proctotomy with a complete division of the external parts. A long, curved, sharp-pointed bistoury, guided by a director, is passed well through the stricture, and the point made to transfix the rectal wall behind the contraction, coming out through the skin by the tip or side of the coccyx. The parts are then cleanly divided by cutting out towards the anus. It is an essential point in this operation that the whole thickness of the stricture be divided. By the tenth day the use of the bougie must be commenced, and passed daily during the whole of the healing process, otherwise, as the wound cicatrises, the contraction is reproduced.

Treatment of tubular strictures.—These are seldom amenable to any form of local treatment. If the stricture be not very extensive, it is possible that some benefit may be derived from bougies, but they rarely do much good. Division of the stricture is generally impracticable from the extent of bowel involved. In such cases a colotomy is the only form of treatment that is likely to save the patient's life, and, if not deferred until the sufferer is too weak and exhausted, it generally affords most favourable results.

PRURITUS ANI.

The irritation and itching about the anus designated by this name is an exceedingly troublesome affection, for, although in no way dangerous to life, it produces great discomfort. Its severity varies considerably, ranging from a slight amount of irritation to an almost intolerable itching. Most frequently the irritation comes on when the sufferer gets warm in bed. Relief is sought by scratching, but this only aggravates the condition by the eczema it produces. On an examination there may be no morbid appearance; but more commonly the skin about the anal margin is red, and thrown into several deep folds, which appear to be drawn within the anus. On separating these folds the sulci are found in an eczematous condition. In old cases the skin has lost much of its suppleness, feeling harsh and rough, while the natural pigment is absent.

The causes are usually both local and general. Amongst the local cause minute thread-worms are common; occasionally pediculi are present; while a vegetable parasite, causing eczema marginatum, is sometimes a cause. The trouble may originate from piles, which, by causing chronic venous congestion, render the skin irritable and liable to eczema.

Many patients with pruritus, if not actually gouty, have a more or less marked lithic acid diathesis, and such cases are commonly complicated by eczematous conditions in other parts of the body.

Treatment.—If a gouty diathesis be suspected, the patient must be properly dieted for a while, and the following prescription may be taken twice daily, three hours after meals, with advantage: Magnesia gr. vj, pot. bicarb., pot. tartratis, $\overline{\text{aa}}$ gr. xv. Regular exercise, so as to produce sweating, should be encouraged, or, if impracticable, a Turkish bath once or twice a week may be substituted.

Local treatment.—If pediculi or thread-worms are present the cure is easy. The free application of the ung. hydrarg. ammoniati is effectual in the former, while injections of lime-water may be tried in the latter. When no such cause can be detected, the following ointments are valuable: Pulv. camph. ʒj adipis ℥i or acidi carbolici ʒss ; ung. hydrarg. nit. ʒij ; ung. petrolii ℥j. The ointment should be applied by the finger both within the anus and around the margin. Sometimes ointments seem to disagree, when a lotion may be well dabbed on the part, such as the following: hydrarg. bichlor. gr. ij, aquæ destil. ℥j, or sodæ biboratis ʒij ; morphiæ hydrochlor. gr. xvj ; acidi hydrocyanici dil. ʒss ; glycerini ℥j ; aquæ destil. ad ℥viij.

Before using either ointment or lotion the part should be well washed with soap and soft water.

In severe cases ease is sometimes obtained by bathing with very hot water, and then keeping a firm plug of lint pressed against the anus. A smooth conical bougie passed two inches up the bowel often gives relief.

If piles or fissure be present, attention must be directed to their cure.

Foreign Bodies.

Owing to the mechanism of the sphincter, it is common for foreign bodies which have safely passed the rest of the alimentary canal to become arrested in the rectum. Foreign bodies are sometimes introduced by the anus, and an extraordinary variety of articles have been thus mislaid. In my work on Diseases of the Rectum I give the details of a case within my own knowledge, in which a good-sized jam-pot was found and removed from the bowel. The method of removal must depend on the nature of the article. Fish bones and similar small objects can generally be taken out without difficulty by the finger and thumb, but if the body be large or firmly impacted, the patient should be placed under an anæsthetic, and the sphincters carefully dilated. By doing this, the risk of tearing or damaging the mucous membrane is much diminished.

IMPACTED FÆCES.

In elderly people it is not uncommon to find the rectum above the sphincter dilated into a considerable pouch. Occasionally in this pouch fæces are allowed to accumulate until they form a hard, compact mass incapable of expulsion. The symptoms, such as constipation, distension, and pain, generally point clearly to the nature of the disorder, but sometimes, owing to a kind of spurious diarrhœa, a mistake in the diagnosis is made. The rectum being full of solid fæces, its mucous membrane becomes irritable, giving rise to a mucoid discharge, which, being darkly stained by the fæcal mass, is mistaken for diarrhœa. In treating these cases purgatives should not be employed, for the obstruction is purely mechanical, and must be remedied by local means. The lower portion of the collection is best removed with the handle of a spoon, after which the remainder can be washed away by copious warm water injections.

POLYPUS.

Two forms of polypi are found in the rectum, viz. the fibrous polypus, and the adenoid polypus; as rare pathological curiosities, dermoid and cystic polypi have been observed.

Fibrous polypus.—This is composed of fibro-cellular tissue, covered by a thin layer of mucous membrane. It commences as a small tumour in the submucous tissue, at first being merely embedded in the rectal wall, but as it grows it becomes gradually extruded into the bowel, pushing the mucous membrane in front of it. After awhile, from the constant dragging on the tumour, the mucous membrane forms a kind of pedicle. These polypi grow occasionally to a large size, and have been removed weighing a pound or more.

Adenoid polypus.—This springs from the mucous membrane, with which its structure is identical. The head, seldom larger than a raspberry, which it much resembles, is finely lobulated; the pedicle, no thicker than a crow quill, is often an inch or two in length. Under the microscope it can be seen that the stalk contains the vessels, and is composed of fibrous tissue. This fibrous tissue on entering the head of the polypus expands, forming a central nodule. Radiating from the centre are fibrous branches, which, subdividing ultimately, form twigs of retiform tissue. Upon these twigs is arranged, in a bipenniform manner, a single layer of columnar epithelium, which thus forms the surface of the growth.

Adenoid polypi are generally single, though occasionally multiple, sometimes forming a grape-like bunch, while at others they are disseminated over a large area of the gut.

Symptoms.—Polypi may occur at any age, being, however, more common in childhood. Such cases are usually brought for advice with the notion that the "body comes down," the polypus protruded at stool being mistaken for prolapse. There is seldom much pain, but hæmorrhage after stool is often observed. An examination for polypus should always be made after an injection, which, even if it does not cause the polypus to protrude, renders its detection with the finger easy.

Treatment.—The sphincter being dilated, the polypus is gently drawn down, and, after the pedicle has been tied as near the base as possible with thick, soft silk, is cut off. If the silk used be too fine, it is apt to cut through the pedicle, and troublesome bleeding may ensue. After removal there is no recurrence.

VILLOUS TUMOUR.

These growths stand on the boundary line between the innocent polypus and the malignant adenoid tumour, differing from the former in having a far shorter and broader pedicle; from the latter, by their growing as a tumour into the cavity of the bowel, and not spreading along the submucous tissue. Their minute structure is identical with the adenoid polypus. Their clinical features are usually those of an innocent growth, though cases are recorded in which they have recurred after removal, and have eventually developed all the characteristics of malignant disease.

Symptoms.—Owing to the innocent nature of the growth, the symptoms may have lasted a considerable period, often for years. There is a sensation of the bowels not being completely relieved, hæmorrhage from time to time, and, above all, what is a characteristic feature of the disease, a thin mucoid discharge of a very glutinous nature. This discharge is at times very copious. Occasionally small fragments of the tissue are broken off and passed per anum, aiding the diagnosis if the disease be high up. To the finger the tumour feels finely lobulated, while the surface has a peculiar soft, velvety feel. The growth can be readily moved about within the bowel, and in this respect differs markedly from a fungating cancer, the only disease for which it is liable to be mistaken.

Treatment.—This consists in complete and free removal.

CANCER OF THE RECTUM.

The form of cancer invading the rectum is almost invariably the adenoid or cylindrical epithelioma. Occasionally the disease is complicated by colloid degeneration. Scirrhous cancer is said to occur in the rectum, but I believe it seldom does so unless preceded by the adenoid growth. Very rarely the disease takes the form of melanotic sarcoma. The adenoid cancer presents two well-marked varieties, the chief characteristic of the one being its tendency to spread as a thin layer between the mucous and muscular coats of the bowel, while that of the other is to increase more uniformly in all directions, thus producing a distinct tumour. The former is the commoner, and it is often not more than a quarter of an inch in thickness, while its area may extend over several square inches. The growth is firmly attached both to the mucous membrane and to the muscular coat. At first it is slightly more raised in the centre than at the circumference, but after awhile the centre becomes depressed and excavated by ulceration.

The ulceration commences in the mucous covering, which it soon destroys, and then eats into the subjacent growth. At first the base of the ulcer consists of the new adenoid growth, but, as this becomes destroyed, the base is formed by the remains of the muscular coats blended into a firm, hard, cicatricial mass by the great hypertrophy of the fibrous bands, prolongations from which extend into the surrounding fatty tissue, and by their contraction draw it towards the disease. Towards the edge of the ulcer the new growth with the hypertrophied, disintegrating mucous membrane is apparent. As the layer of disease spreads it is not always in a regular manner; it usually extends more rapidly laterally than in the long axis of the bowel. The result of the lateral extension is often seen in the whole circumference of the bowel being affected by a comparatively narrow ring of growth. It sometimes happens that, after the destruction of the mucous membrane, instead of the subjacent adenoid growth sharing the same fate, it continues to increase, especially in certain points, and projects as a fungoid mass into the bowel cavity.

In the second variety the disease forms more or less of a distinct tumour. It commences in a similar manner to the one just described, but instead of spreading as a thin layer it increases in size pretty regularly in all directions, forming a distinct tumour projecting into the bowel cavity. Such a nodule may attain the size of a pigeon's egg or even larger, yet still retain an intact mucous membrane over its surface. But the mucous membrane after awhile gives way, and the growth, released from pressure, quickly forms a fungating mass projecting into the rectum.

Generally the tumour is single, though occasionally there are several nodules sprinkled over a considerable area.

These tumours vary much in their consistency, some being so soft as to break down on the slightest pressure, while others are fairly firm. It will be generally found that the firmness of the tumour is in inverse proportion to the rapidity of its growth. It may be gathered from this sketch of the disease how the appearances under the microscope differ according to the portion of tumour examined, and the length of time it has been growing. Sections involving the older portions of the disease, and in which the adenoid growth has been destroyed by ulceration, will show little more than dense fibrous tissue, while those from the growing margin will show the cellular growth in varying stages of development towards adenoid structure. It seems probable that, notwithstanding that the tumour is first observed in the submucous tissue, it in reality originates from some morbid influence affecting the epithelial cells lining the Lieberkujnian follicles. The new growth can be seen by the microscope to be nothing more than a vast development of a gland tissue, nearly identical in structure with the tubular glands of the mucous membrane.

If the new adenoid growth be rapid, both the cells and retiform tissue composing it are embryonic and ill developed, while in some of the more chronic cases the gland structure is so perfect as closely to resemble the natural follicles.

Symptoms.—The disease commences insidiously, the earliest symptom being little more than a slight uneasiness about the part, just sufficient to irritate the patient from time to time without amounting to actual pain. As the disease advances more definite symptoms appear; these are very varied, the more important being pain, bleeding, discharge, diarrhœa, constipation, and cachexia.

Pain.—This is seldom an early symptom, and is commonly the result of morbid changes in an advanced stage of the disease. At first discomfort merely is experienced, especially after walking or sitting long in a constrained position. There is often an uncomfortable feeling of wanting to stool, yet upon trial nothing but a little mucus is passed. As the disease advances pain generally increases, but so far as my experience goes, it depends greatly upon the situation of the disease. When the growth is near the anal margin, the suffering is greater than when situated higher up the bowel; indeed, I have more than once been astonished at finding a considerable mass of cancer high up the bowel in cases where the disease had not been suspected on account of the little pain experienced. When ulceration and stricture are present there is always much distress, and the part is liable to attacks of inflammation, at which time the pain is very severe.

Bleeding.—This is almost sure to take place at some period. In the early stage it is slight, and is furnished by the congested mucous membrane in the neighbourhood of the growth. The severe hæmorrhage which sometimes occurs in the latter stage of the disease is the result of ulceration of a hæmorrhoidal vessel.

Discharge of a muco-purulent nature from the anus generally exists. At first this is but slight, consisting of simple mucus, and only passed at stool; but it becomes purulent after ulceration has taken place, while at a further stage of the disease it becomes dark and highly offensive, forming the "coffee-ground discharge" so often described.

Diarrhœa is an intermittent symptom. The sufferer often has a sensation as if requiring to stool, especially in the morning, and after a little straining, passes a small quantity of fæces, as well as some muco-purulent material. He does not feel, however, as if the bowel had been emptied, and may have recourse to the closet many times, passing a muco-purulent discharge rather than any true fæcal evacuation. In using the term diarrhœa, the surgeon must not be misled by regarding the evacuation as a simple looseness of the bowels. Indeed, when there is any stricture present, the so-called diarrhœa is often but a symptom of extensive fæcal collection behind the contraction. What the patient passes in these cases is a purulent mucoid discharge, stained by small particles of fæces washed from the surface of the collected mass.

Constipation is a symptom of the utmost importance as a means of diagnosis, if the disease be too high for digital detection. It may exist to almost any extent, from a slight trouble at the commencement to a grave complication later on. The motions are often small and narrow, or passed in small fragments after much straining. Complete obstruction is not uncommon in the later stages of the disease.

Cachexia, loss of strength and weight, are always present after a while, although often not particularly marked at the commencement.

The foregoing symptoms are of the highest importance in calling attention to the probable existence of cancer, and have to be relied upon if the disease is high up the bowel, but in the lower part of the rectum a positive diagnosis can be established by a digital examination.

The margin of the anus should be carefully scrutinised for any portion of growth that may be in sight. Sometimes a fungating projection from the anus at once shows the nature of the disease. More commonly the anus is normal, or merely red and œdematous from the irritation of the discharge. Upon introducing the finger the condition of the part will depend upon the time the disease has existed, the portion of bowel implicated, and the physical characters of the growth. Commonly a certain interval of healthy bowel exists between the anal margin and the lower border of the disease. The growth is generally situated about two or three inches from the anal outlet.

The extent of the disease varies from the smallest patch to the whole calibre of the bowel, for several inches. At an early period an induration alone may be detected, being rather a thickening of the bowel coats than a distinct tumour. At this time the mucous membrane is not ulcerated, but is somewhat pushed into the bowel cavity. Generally, by the time the case comes under clinical observation, considerable ulceration has occurred, and the finger can distinctly feel the firm base of an ulcer, with abrupt, hard, everted edges, the disease apparently terminating somewhat abruptly in the healthy tissue. If the disease has extended so as to form a distinct tumour in the submucous tissue, the lump or lumps can be felt projecting into the bowel cavity. More rarely the rectum seems studded with hard small nodules. Occasionally a soft fungoid mass can be felt blocking up the bowel. Very commonly a stricture exists, around which is a hard nodular deposit.

Differential diagnosis.—With ordinary skill in examination and from careful consideration of symptoms, there are few disorders liable to be confounded with rectal cancer, yet at times considerable difficulty may be experienced in forming an accurate diagnosis. The diseases likely to be confused with cancer are, villous tumour, fibrous stricture, and fibrous growths from the prostate.

Villous tumour.—This can only be mistaken for the soft fungating masses occasionally springing from a malignant growth. Here the duration of the disease helps the diagnosis. When cancer forms a fungating tumour in the rectum, its course is always very rapid. Villous tumour, on the other hand, is chronic, and may remain for months or years with but little change. The discharge differs materially in the two diseases, that from a villous tumour, though very free, resembles normal mucus, being viscid and fairly clear; in cancer it is purulent and darkly stained. To the finger a different sensation is communicated by the two diseases. The villous tumour has a peculiarly soft and velvety feeling, while at the same time it gives the impression of being fairly tough and resistant. The cancer, though soft, is very friable, and bits readily break off on slight pressure with the finger nail, while the surface of the growth feels harsh, as if from an absence of secretion. In fungating cancer, although the mass itself is soft, the walls of the bowel from which it springs are always indurated. Lastly, a large villous growth may be present in the rectum, with very little disturbance to the general health, which is not the case in cancer.

Fibrous stricture.—In the majority of instances, by paying attention to a few points, there is very little difficulty in recognising the distinction between fibrous and malignant stricture, but occasionally the diagnosis is extremely difficult. In malignant stricture, the portion of mucous membrane between the stricture and anus is generally fairly healthy, that is to say, the mucous membrane is soft and unulcerated; in fibrous stricture it more frequently happens that this part of the bowel has lost its soft and supple condition, being rough and fasciculated, the mucous membrane being partly replaced by cicatricial tissue. In cancer the bowel is often firmly fixed, so that it cannot be made to move when the finger is introduced. The hard, abrupt, nodular edge, so common at the lower border of the stricture in cancer, is generally absent in fibrous stricture, the entrance into which either presents a thin edge or is funnel-shaped. The duration of the disease is also important, cancer, when it has advanced so far as to produce stricture, running a rapid course.

Fibrous enlargements of the prostate.—These, by encroaching on the rectum, occasionally produce symptoms of obstruction which have been mistaken for cancer.

Treatment.—This will be considered in the following order: 1. Excision. 2. Colotomy. 3. Palliative.

Excision.—The question of excision of the rectum is one of great gravity. When the disease is limited so that it can be removed without much danger the operation is of great value; but when extending widely the chance of permanent good is too small to justify the increased risk involved by the operation. In my Jacksonian prize essay on rectal excision a table of mortality showed a death rate of 17 per cent.; but if cases suitable for excision were more carefully selected, I feel sure the mortality would be much less. In support of this view I may state that I have had no death from the operation in eighteen cases. It is not possible to lay down any arbitrary rules as to the cases suitable for excision, but speaking generally, the following points serve as a reliable guide: 1. The height of the disease. 2. Its position. 3. The implication of neighbouring structures. 4. The general constitutional condition of the patient.

1. *The height of the disease.*—If, after a thorough examination under an anæsthetic, the finger cannot be passed beyond the growth, an operation should not be undertaken. Four inches I consider to be the limit that can be explored by the finger. It cannot be said that it is impossible to remove a greater extent of bowel; but when once beyond the reach of the finger, it is impossible to know accurately how high the disease extends, or what connections it has formed, so that after an operation of great danger and severity it would be very doubtful whether the disease had been removed.

2. *The position of the disease.*—When situated on the posterior wall the case is much more favourable than when in front.

3. *The implication of neighbouring structures.*—If, when the finger is introduced, the bowel at the site of the disease feels fairly movable upon the neighbouring structures, it implies that the growth has not extended beyond the rectal walls, and can therefore be removed. On the other hand, should the bowel feel hard, rigid, and firmly bound to the surrounding structures, the case is an unfavourable one for operation. The rigidity and fixity of the bowel almost certainly implies an infiltration of cancer into the neighbouring tissues, so that removal of the rectum does not mean the removal of the disease. The adhesion,

which is commonly found between the diseased gut and the lower part of the vagina, does not, however, prevent an operation, for the mucous membrane of the vagina can generally be peeled off the subjacent growth.

4. *The general condition of the patient.*—If the patient be feeble, with the general health much broken, it often implies secondary deposits in tho abdominal viscera, the liver being especially liable to infection, in which circumstance no operation should be performed. Age is no necessary bar to the operation; but if the local conditions are only doubtfully favourable, it would be right to give a young patient the chance of an operation, which in an older person would be unjustifiable.

Taking all cases of rectal cancer, at the time of coming under the surgeon's observation, those which fulfil the conditions for successful extirpation are unfortunately exceptional, but that the operation in well-selected instances is of the utmost benefit admits of no question. A considerable period of fair health may be enjoyed before recurrence takes place, and I have known cases in which years have elapsed after operation without pain, discomfort, or symptoms of return; and it is just possible that a permanent cure may be occasionally effected, as sometimes occurs after the removal of cancer from other parts.

Method of operating.—The patient being placed in the lithotomy position, the bowel is divided in the middle line behind, from the anus to the coccyx. The rectum is then separated from the anal margin, by making deeply a crescentic incision, extending from the margin of the first cut, round the anus, to a point in the middle of the anterior margin. This cut should be made boldly, and of sufficient depth to extend well into the fat of the ischio-rectal fossa. The fore-finger, thrust into this incision, will readily separate the bowel from the surrounding tissue, except at the insertion of the levator ani, which must be divided with scissors. The lateral and posterior portions of the bowel being then freed from their attachments, the next and most delicate step is to detach the bowel in front. This is accomplished by careful dissection with the knife, for it is too intimately adherent to be separated with the finger nail without greatly tearing the parts. When the bowel has been detached a sufficient distance beyond the disease, it must be drawn down and cut off with strong curved scissors. No attempt is made to draw down and stitch the divided bowel to the skin. The subsequent treatment is of the simplest kind, consisting of keeping the wound clean with weak antiseptic washing, and covering it with a light pad of cotton wool, dusted with iodoform powder. Care should be taken to let the wound heal over a full-sized bougie, or undue contraction will follow. Control over the bowel is generally regained in a couple of months.

Colotomy.—In cases unsuitable for excision, the question arises whether colotomy would afford relief. Rectal cancer at an early period often produces but slight distress. There may be neither pain nor constipation, and with the exception of a little morning diarrhœa, the discomfort may be so slight as not to interfere with the daily avocations of the patient; in these circumstances there is no indication for colotomy.

When the symptoms of stricture once commence they are progressive. The frequent fluid stools, combined with advancing signs of obstruction, gradually exhaust the patient, while, not uncommonly, life is terminated more abruptly by complete obstruction, or by peritonitis resulting from perforation. When the symptoms of stricture, therefore, become prominent, I advise colotomy without delay. The benefit afforded is generally very great. Patients who have been harassed for months are at once relieved of their most distressing symptoms, and the closing period of life is passed in comparative rest.

Palliative treatment.—If colotomy has been deferred or refused, something may yet be done to render the patient more comfortable. The diet requires careful attention. It should be of a nourishing description, and taken as far as possible in a concentrated form, in order to diminish the amount of fæcal material. If the bowel be very irritable, I have frequently seen much benefit follow a pure milk diet. Valentine's meat juice may be sometimes tried with advantage in conjunction with the milk. If it agrees with the patient a dessert spoonful of cod-liver oil three times daily seems to retard emaciation, while it certainly renders the motions easier. Purgative medicines must be avoided; they may set up a violent diarrhœa difficult to control, while if administered for obstruction they are positively dangerous. There is no objection to the occasional use of a mild laxative, such as a small quantity of Friedrichshall water or liquorice powder. When the nights become restless and the pain considerable, opium is a valuable drug.

The local treatment is important. The parts must be kept scrupulously clean, great care being taken to prevent the collection of acrid discharges about the anus. The part should be thoroughly washed with soft water, dried with a towel, and dusted with oxide of zinc and starch powder (gr. xx to ʒj). The diarrhœa and tenesmus, so troublesome a symptom in the later stages, seems sometimes to be caused by the ulcerated surface of the growth, but in some of the more troublesome cases it results from a considerable mass of fæcal material accumulating above the stricture. The bowel is thus never properly evacuated, only a portion of the mass coming away with the copious mucoid discharge its presence occasions. In these cases great comfort and relief follow the daily use of a warm water injection; it clears the bowel above the disease, thus removing the source of irritation. To be effective a Higginson's syringe should be attached to the half of a No. 8 black soft catheter. The catheter must be gently passed well beyond the disease. After the injection has all come away, half an ounce of warm thin starch, to which twenty drops of liquor opii have been added, thrown up the bowel and retained, is very soothing.

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IX. DISEASES OF THE BREAST.

Prof. W. Mitchell Banks.

Neurotic conditions of the mamma, uncomplicated neuralgia, and hyperæsthesia.—These conditions almost always occur in young women. They are certainly not found in the aged. The neuralgic pains are sometimes very severe indeed, shooting down the arm and into the armpit. There may exist along with them an extreme sensitiveness of the gland or of the skin over it (hyperæsthesia), so that the slightest pressure apparently causes the most exquisite suffering. On examining the breast nothing can be detected unless it be a little general fulness. The exception to this statement is where neuralgic pain accompanies chronic lobular inflammation (as mentioned at page 344); but then, that is very specially a complaint, not of youth, but of middle life. In truth, the mammary neuralgia and hyperæsthesia of young women are always the result of some perverted ovarian condition, and without doubt the moral element enters very largely into their nature also. So that to lay down accurate rules for their diagnosis is useless. Some general medical experience, and a certain knowledge of human nature, are all that is required rapidly to pick such cases out from among those of serious import. The young practitioner may remember for his comfort that mammary pains in young women, where no distinct growth is to be felt, are not of much consequence, and that the more violent the pain and the more acute the sensitiveness, the less is the danger. As regards treatment, all local measures should be carefully eschewed, and the patient's mind should be diverted from the subject of her breast or breasts altogether; while tonics, cold baths, wholesome food, fresh air, hard beds, country exercise, abstention from novels, and rational mental occupation should be enjoined.

ACUTE INFLAMMATION OF THE BREAST: MASTITIS.

Acute inflammation in adolescents.—In young unmarried women the breast is occasionally the seat of inflammatory attacks for which no very reasonable cause can be assigned. The subjects are most commonly girls of a weak constitution, or, if not so, they have for the time being got below par in their general health. This inflammatory condition may even go on to the formation of chronic or cold abscess. It is the special and characteristic disease of the mamma, say between the ages of sixteen and twenty. So that any swelling in the breast of a young woman at that period of life will in the great majority of instances be found to be an inflammatory lump or a cold abscess. The diagnosis is the chief point.

Acute inflammation during pregnancy and lactation.—So incomparably more frequent is this form than any other, that statistics have shown that out of every twenty-two cases about eighteen occur during lactation, one or two during pregnancy, and only three at other times. It is most common in primiparæ, while those who do not suckle their own children generally escape it. It commences most frequently within the first month after parturition, as might have been expected, or again towards the end of a prolonged period of suckling, when the mother has been weakened by an excessive drain.

Among the **causes** of this affection must be reckoned the fact that the breast sometimes secretes its milk so rapidly and plenteously that its ducts become over-distended and irritated. More especially is this the case when, from weakness of the infant or its death, the breasts cannot be regularly and completely emptied. It might seem as if the fact of women who do not suckle their own children seldom having mastitis was opposed to this view. But it must be remembered that the very reason why a large proportion of such mothers do not nurse their infants is because they have little or no milk to begin with. However, without doubt by far the commonest origin of mastitis is some mischief associated with the nipple, which is often cracked and sore, or may be shrunken and retracted, so that the child irritates it by vainly tugging at it, while the nipple itself does not give a free vent to the milk. This irritation is probably propagated along the lymphatics. Occasionally the inflammatory process attacks the gland in its entirety, but usually it is located in a few lobules.

The chief features of a typical case are somewhat after this fashion. About a fortnight or three weeks after delivery the patient experiences a little stiffness and soreness, very commonly at the lower and outer part of the breast. Presently she has a feeling of chilliness, or even a rigor. Then she becomes feverish, with a high temperature, hot skin, quick pulse and loaded tongue, while thirst and headache are often present. The inflamed lobules become hard and knotty, while the breast throbs and feels as if ponderously heavy. The affected lobules soon run together into one hard swelling, over which the skin becomes tense and somewhat livid. If suppuration occurs there is often another rigor, with perspirations, while the skin over the mamma becomes œdematous, and pits on pressure.

The first object of **treatment** must be to give the inflamed organ physiological rest. To this end, if the affection occur during lactation, the infant should no longer be allowed to suck, and this not merely as regards the affected breast, but as regards both. For the act of suckling the sound organ keeps active the secretion of milk in the other breast. By promptly removing the infant and feeding it artificially, the inflammation may be subdued in so short a time as to allow its return to suckling before the milk has entirely departed. In the meantime the breast must be regularly emptied of its contents by the pump, applied with all care so as not to irritate it. In the case of a robust and full-blooded young woman with a sharp attack of mastitis, accompanied by much pyrexia, it would be quite justifiable to employ local depletion of the breast by leeches, to keep the bowels free by a moderate dose of Epsom salts in hot water given early in the morning, and to lower the pyrexia by very minute doses of antimony or aconite, given every hour, after the so-called homœopathic fashion. But in the majority of cases the patients are far too weak to permit of this treatment, and require from the commencement to have all their strength carefully husbanded. Tonics, rest in bed or on the sofa, with a light, easily digested diet should be prescribed, while the arm on the affected side should be kept perfectly quiet.

As regards local treatment, the breast should be slung from the neck with a handkerchief to prevent all dragging. At least three times in the twenty-four hours it should be fomented for some minutes with a large conical sponge wrung out of very hot water. Extract of belladonna, reduced with water or glycerine to the consistence of thick paint, should then be copiously smeared all over it, after which it should finally be covered with lint wrung out of warm water, or hot lead and opium lotion, with light waterproof over all. In America the plan of applying cold by ice bags, in the hope of checking the inflammation in the early stage, has found considerable favour.

Should it be pretty clear that an abscess is about to form, as indicated by localised redness of the skin at one particular point, with general surrounding œdema, poultices will give relief. On the other hand, the acute condition may subside, leaving behind it a certain chronic state of induration, which can be dealt with by the remedies suggested under the next heading. It is of great moment that all traces of the inflammatory process should be thoroughly cleared away, as there seems little reason to doubt that a certain number of cases of carcinoma take their starting point in some indurated lobule left after an attack of mastitis.

CHRONIC LOBULAR INFLAMMATION.

Causes.—This is seen in married women, both among those who have borne children and those who have not, and is of frequent occurrence in unmarried women as well. The period when the menstrual functions are about to cease is undoubtedly the time of life at which it most usually occurs.

Detached lobules of the breast become hard, lumpy, and nodulated, and this, as a rule, slowly and with very little pain; only slight uneasiness and an occasional twinge. The disease commences as an inflammatory condition of the connective tissue, which becomes infiltrated with small round cells. These develop into fibrous tissue, which presses upon the acini and ducts. By this pressure their epithelium is rendered fatty, and they themselves become ultimately obliterated. The process, therefore, is a kind of cirrhosis, with its stage of increase in bulk while the fibrous tissue is being developed, and its stage of shrinkage when the secreting glandular tissue has been obliterated.

Sometimes one of the affected lobules is intensely indurated, and this is what renders the complaint of great moment, inasmuch as, of all the non-malignant conditions which affect the breast, it is the one which presents the great difficulty in **diagnosis from carcinoma.** The two conditions to the touch are almost identical, and the patients are at a time of life when they may be subject to either. What are the points of difference? The inflammatory condition is more leathery, and not of such stony hardness as the carcinomatous. The integument over it is not adherent, and, when pinched up, does not present the punctated pig-skin appearance, which is found over a carcinoma situated near the surface. It may, however, be a little dimpled from adhesion. Usually more than one lobule is involved, and this is a great help in diagnosis, as genuine tumours are always single. The whole breast, indeed, is sometimes so generally indurated that it feels like a hard nodulated cake. Moreover, the other breast very often presents more or less of the same condition. At the monthly periods the affected lobules sometimes undergo a distinct temporary increase in size, doubtless from congestion. The axillary glands are not altered, or, if they are, they are only slightly enlarged and not hard. The nipple is not retracted as it is when carcinoma is seated beneath it. Under appropriate treatment the inflammatory condition either remains stationary or recedes, but malignant disease steadily, though quietly, increases in spite of everything.

From fibroma, adenoma, or simple cyst, the chief diagnostic point is that the inflammatory condition, like carcinoma, wants definition, and passes by degrees into the healthy breast tissue, while the others are movable, definitely circumscribed tumours.

Chronic lobular inflammation accompanied by neuralgia.—It has just been stated that chronic lobular inflammation is seldom accompanied by pain, or, as a rule, only by an occasional shoot or twinge. But when the complaint occurs in women of a neurotic tendency, and specially if unmarried, there may be considerable pain of a neuralgic character. Doubtless much of this is mental, being produced by extreme anxiety from dread of cancer, which magnifies every ache a hundredfold, while some of it is often caused by the patient feeling and handling the breast in order to find out whether the lump in it is growing or not. However caused, it is a most serious element in producing difficulty of diagnosis between the malady under consideration and fibrous carcinoma or scirrhus. Indeed, so great does this difficulty sometimes become, that it is quite justifiable to explain the exact state of matters to the patient and ask permission to make an incision into the lump. If it is inflammatory, no harm will have been done. If it is malignant, then the proper steps must be taken, for which eventuality the patient's consent should always be obtained before the anæsthetic is given.

Treatment.—The patient should use the arm on the affected side as little as possible. A riband should be worn round the neck into which the hand can at a moment be slipped so as to rest the arm. Morning and evening the breast should be well bathed with hot water, and then gently rubbed with linimentum potassii iodidi cum sapone, or with a 10 per cent. oleate of mercury. Stays should be removed so as to prevent all friction. Over the breast a layer of cotton wadding should be placed, and pressure with support applied. This is best done by four or five turns of elastic webbing bandage (such as is applied over antiseptic dressings), commenced below the breast and carried upwards. In this way any amount of pressure consistent with comfortable breathing can be obtained. Small doses of iodide of potassium probably constitute the most efficacious form of internal remedy. To do any good, this treatment must be kept up in most cases for several months, but if the patient be thoroughly in earnest over it and carry it out completely, it will certainly be of service.

MAMMARY ABSCESS.

Superficial and intraglandular abscess.—An acute inflammation of the mamma having failed to undergo resolution may end in suppuration and abscess, the general symptoms of which are identical with abscess anywhere else. The pus may form immediately beneath the skin, constituting a *superficial abscess*, which is a comparatively mild affair, and seldom productive of much trouble. Or it may form deeper down in the substance of the gland, constituting the true *mammary* or *intraglandular abscess.* Sometimes suppuration occurs simultaneously at several points in the gland, and, if no proper vent is given to the pus, the whole organ may become riddled with sinuses and abscess cavities to the complete destruction of the patient's health. One frequently sees in hospital practice women who have persisted in suckling with the sound breast while suffering the greatest agony in the other, and who in consequence have been brought to death's door by pain and exhaustion.

Post-mammary abscess.—Here pus forms either primarily in the connective tissue between the mamma and the great pectoral muscle, or, originating in the deepest lobes of the gland, bursts into the connective tissue area. Necessarily it has great difficulty in getting to the surface. Sometimes it slowly burrows its way right through the gland, but more generally it spreads beneath it and escapes just below its circumference or towards the auxiliary border thereof. As it accumulates it pushes forward the whole breast, which in consequence has a prominent conical appearance with a uniformly smooth and tense surface. It should be remembered that post-mammary abscess may arise from the bursting of an empyema behind the breast or from the presence of a necrosed rib, both of which conditions, of course, need special management.

Treatment.—The first thing, if it has not been done during the inflammatory stage preceding the formation of matter, is to wean the child from both breasts. So soon as pus is recognised to be present, it should be let out. The breast being exquisitely tender, and the patients being sensitive women, with a horror of the knife, the surgeon too often commits the error of merely "puncturing" or "pricking" the abscess, in place of thoroughly evacuating it. The proceeding which will in the end prove by far the most satisfactory is to give the patient an anæsthetic, freely open the abscess from end to end, put in the finger and break down all softened tissues, thoroughly wash the cavity out, pack it tightly with lint dipped in carbolised oil, and put on a light poultice. As soon as possible poulticing should be left off, and water dressing applied, while the cavity is kept open by a little lint pledget or a drainage tube. In justification of the early and very thorough evacuation of mammary abscess, I can only say that I have never yet seen one of those breasts which are riddled from end to end as just described, which was not the result of two things: imperfect opening and over-poulticing. In a case when the breast is undermined with sinuses, a great deal can be done by slitting open the largest of them, while, with a Volkmann's spoon, the rest are thoroughly scraped and cleaned out. After this they may be packed with lint steeped in turpentine, which has a remarkably sweetening and cleansing effect, while the breast is covered with lint dipped in an antiseptic lotion. After the abscess cavities and sinus tracks have been rendered healthy, much may be done by firm compression of the breast either by strapping or by the use of elastic webbing bandage. There are a few cases, where the breast is so hopelessly disorganised and the patient's health so reduced, that the best thing is to slice up all the tracks at any cost and pack them well. Even after the breast has, so to speak, been almost cut in pieces, it is surprising to note the rapidity with which healing occurs, and at the very complete use of the organ afterwards for suckling purposes. In certain very bad cases the whole gland has been excised, but this seems quite an unjustifiable proceeding.

TUMOURS OF THE BREAST.

The table given on page 349 is based upon the **classification** suggested by Gross, and an attempt is made in it to reconcile the modern genetic and anatomical mode of division with the old clinical method, which possessed, as its starting point, innocency or malignancy.

Many of these tumours are of such rare occurrence that nothing need be said about them, such as pure fibroma, lipoma, myxoma, chondroma, angeioma, and neuroma. In the breast they are merely surgical curiosities. The description of them given under the general head of tumours will suffice.

As regards the remainder, there is little difficulty with the carcinomata, the pure sarcomata, and the pure adenomata. But there is a considerable group of tumours, the next in frequency to carcinoma, which are not composed of one tissue alone, but are mixed. The salient feature in this group is the fact that they all contain, in greater or less quantity, a certain amount of adenomatous tissue, that is to say, of a material which is exactly identical with an imperfectly developed piece of normal breast substance. To these mixed tumours the prefix *adeno* may be given. When fibrous tissue is in excess, the tumour is an adenofibroma; when the acini and imperfect ducts of an

1. Neoplasms derived from the connective tissue of the gland, and representing this tissue in its fully developed state	Non-malignant	Fibroma (fibrous tumour), Lipoma (fatty tumour), Myxoma (mucous tumour), Chondroma (cartilage tumour).
2. Neoplasms derived from the connective tissue of the gland, but representing this tissue in its embryonic or immature state	Malignant	Sarcoma.
3. Neoplasms derived from the epithelial or secreting elements of the gland, the general type of which they maintain	Non-malignant when pure, but apt to become malignant when mixed with certain other tissues	Adenoma, either pure or mixed in varying proportions with fibrous tissue (adeno-fibroma), with cysts (adeno-cystoma), or with round, spindle, or giant cells (adeno-sarcoma).
4. Neoplasms derived from the epithelial or secreting elements of the gland, but atypical in their character	Malignant	Carcinoma.
5. Neoplasms formed by an hypertrophy of highly organised structures	Non-malignant	Angeioma (vascular tumour) and Neuroma (nerve tumour).

adenoma take on a cystic formation, the growth becomes an adeno-cystoma; when spindle, round, or giant cells form the bulk of it, it is an adeno-sarcoma. It is quite true that investigators are not agreed upon the point as to whether the adenomatous tissue found in these tumours is of absolutely new growth, or whether it is not merely ordinary gland tissue which has been caught up by a neoplasm (fibrous, cystic, or sarcomatous), reduced to an imperfect state, and incorporated with it; but the bulk of evidence is in favour of the adenomatous tissue being of new origin, while it is difficult to imagine a fibrous tumour, for example, which never takes up and incorporates structures in other parts of the body, acting in a special and peculiar manner when it happens to grow in the breast. I perfectly admit that this is only a working table, and that so much has yet to be made out about the early origin of breast tumours that nothing at present can be considered as finally settled; but, though not pathologically final, it is pretty nearly so from a clinical point of view. It is reckoned that out of every 100 breast growths, about 83 are carcinoma, and 17 are sarcoma, adenoma (and its compounds), or cysts.

ADENOMA AND ITS COMPOUNDS, ADENO-FIBROMA, ADENO-CYSTOMA, AND ADENO-SARCOMA.

Pure adenoma.—This tumour may most aptly be compared to a piece of mammary gland tissue from a pregnant woman in which a proliferating growth of acini and ducts is taking place as a preparation for lactation. The one difference is this, that in the gland nature arranges the acini into lobules, and unites their ducts so as to form a completed excretory apparatus, while in the morbid growth she stops short, failing to complete the process, and only making a confused mass of acini and ducts which have no coherent relation to each other. The microscope shows on section an infinity of spaces, some round, some flattened, some slit-like, lined with a cubical epithelium, sometimes in one, sometimes in several layers. These spaces have a distinct membrana propria, which separates their epithelium from the surrounding connective tissue so that they do not infiltrate it, and this is one of the characteristic features of the growth. It is a movable tumour, eminently distinguished by a nodulated or bossed surface. In consistence it is hard and resisting. It is of slow and equable growth, taking many years often to attain a troublesome size, and generally occurs in married prolific women about thirty or thirty-five years of age. There is no retraction of the nipple and no involvement of the lymphatic glands. After removal there seems a certain tendency to reproduction, unless the extirpation has been very freely performed. A perfectly pure adenoma is one of the rarest tumours of the breast. Gross could only find accurate records of a very few, and had only seen one himself.

Adeno-fibroma.—This, on the other hand, is the commonest of all the non-malignant tumours of the breast. It is the old chronic mammary tumour of Sir Astley Cooper, which by many recent authors is called adenoma, although it is not made of pseudo-glandular tissue entirely; and by others fibroma, although it is not pure fibrous tissue. Under the classification here adopted it is to be considered an adenoma in which the periacinous connective tissue has become greatly hypertrophied, while the pseudo-glandular or adenomatous material has diminished. It is most commonly found in healthy young women, and is of very slow growth, often remaining stationary and showing no tendency to degeneration.

It is a movable, floating tumour; hard and ovoid as a rule, and generally slightly nodulated. It is completely encapsuled, and shells out easily. It does not retract the nipple, nor tuck in the skin, nor affect the glands. It is painless, except in the case of a few anæmic and neurotic women in whom pain of a neuralgic character is an accompaniment. When small it is apt to be confounded with a very tense solitary cyst, and sometimes the likeness is so great that an exploring needle can alone make the diagnosis certain. From carcinoma it is distinguished by the youthful age of the patient and by its well-defined and circumscribed outline, and this latter character also enables us to diagnose it from a mass of chronic lobular inflammation.

Adeno-cystoma (cysto-sarcoma, sero-cystic sarcoma, or glandular proliferating cysts).—Seeing that adenomatous tissue practically consists of a collection of closed cavities with epithelial linings, which secrete a small amount of fluid, we have precisely the conditions which naturally lead to the formation of cysts. One is therefore prepared to find that cystic change is one of the commonest occurrences in adenomata, and accounts for the cysts which are occasionally to be found even in such hard and solid growths as the adeno-fibromata. There are certain tumours, therefore, in which there is at first no excessive hyperplasia of the periacinous connective tissue, while, on the other hand, the acini and imperfect ducts become dilated into cysts to such an extent that the growth becomes an adeno-cystoma. A most noteworthy feature is the fact that the cysts do not necessarily remain as walled cavities, growing larger and larger under the pressure of contained fluid. On the contrary, the periacinous tissue at some point pushes its way into the cyst with the result of forming intracystic growths of every kind, varying from solid masses with broad pedicles to vegetations and dendritic growths of the most delicate description. It should be carefully remembered that none of these arise inside the cysts, but are really projections inwards of the surrounding tissue, exactly as the lung may be regarded as projecting into the pleural cavity.

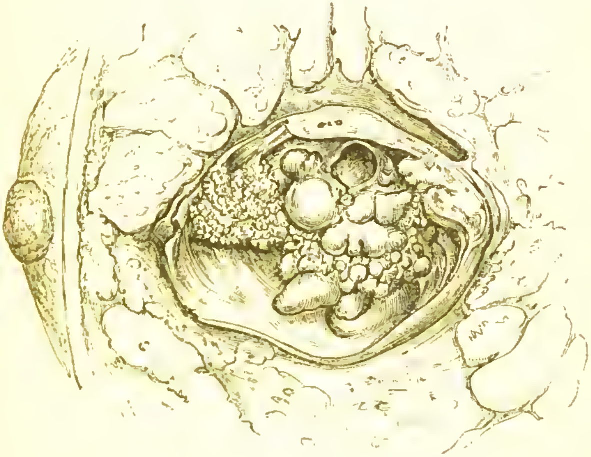

Fig. 30.—A Cystic Tumour of the Breast, with Intracystic Growths.

To such an extent may the intracystic growths proceed, that they sometimes completely fill up the cavities, although they never, even under the greatest pressure, obliterate their epithelium-lined walls. A section shows a dense white or cream-coloured lobulated mass, studded with cysts. Some are most minute, others as big as a crab-apple. They contain a clear brownish-coloured fluid, and the layers are usually more or less filled with intracystic growths. When these growths have filled up the cavities completely, the tumour appears practically solid, but if it be hardened in spirit, these outlines reappear, and the section looks like that of a cabbage. The growth is always completely encapsuled, and has no tendency to infiltrate the breast tissue.

The tumour is most frequently met with at a more advanced period of life than the adeno-fibroma,

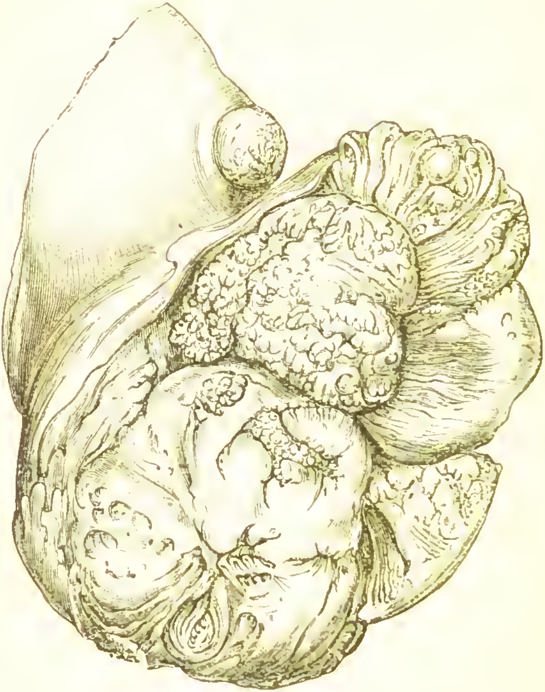

Fig. 31.—A Fungating Adeno-sarcoma of the Breast with Cysts. No return seven years after removal.

usually occurring between thirty and thirty-five years of age. It is hard, heavy, movable, and slightly nodulated, while if large cysts be present, they are distinguished by their prominence and elasticity. In its other features it closely resembles the adeno-fibroma. It is of slow growth, but sometimes after existing for many years it suddenly increases and attains a great size in a very short time. Under such circumstances it so presses upon the skin that this gives way before it, and then the tumour, relieved from tension, protrudes in the form of a true, sprouting fungus. Covered with granulation tissue, it appears as a bleeding mass, secreting a watery discharge and presenting to the eye a most malignant appearance. It may even endanger the strength and life of the patient. Nevertheless, it cannot be said to present any of the true characters of malignancy, inasmuch as it does not affect the glands or distant organs, and does not recur if thoroughly removed.

Adeno-sarcoma.—Here the periacinous tissue, in place of assuming the character of fully formed fibrous tissue, assumes that of the embryonic connective tissue type, and "may be composed of small spindle cells, with numerous fibres between them, of imperfectly developed fibrous tissue infiltrated with small round cells, of large spindle cells, of delicate fibres with stellate cells and mucous intercellular substance, or of various combinations of these structures."* Cysts are often scattered through it. When commencing early in life, it may remain for long periods without making much advance, and then suddenly burst into activity. But when it arises in middle life, it usually grows quickly from the first. In general feeling it is barely to be distinguished from the adeno-cystoma, except by its more pronounced elasticity. Its section is lobulated, and has been well compared to a mass of rice or sago jelly. Its position in point of malignancy can only be determined by a careful microscopic examination. The more fibrous in character the more innocent are the tumours, while those which are juicy and rich in round-cell infiltration are practically on a par with pure sarcomata, from which they are not to be diagnosed before removal.

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* Beck in Erichsen's "Surgery," 1884.

SARCOMA.

Pure sarcomata occur in the breast just as they do in any other soft tissue. It is impossible, however, to say what proportion they bear to other tumours because there is no doubt that the solid forms of adeno-cystoma and the adeno-sarcomata have been hitherto so confounded with them that no reliance can be placed upon statistics. Some years of careful examination with all the modern appliances of hardening and staining will be necessary before figures can be of value. The general characters and behaviour of sarcomatous growths are described under the heading of tumours, and need not be repeated here.

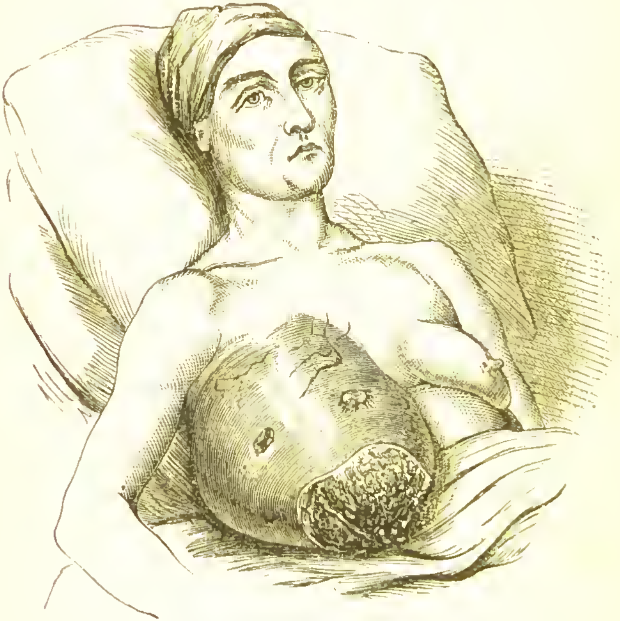

Fig. 32.—A Fungating Sarcoma of the Breast. (After Billroth.)

It is thought that the large spindle cell variety is the commonest, while the small round cell variety is fortunately not so common. Its malignancy entirely depends upon its structure, the round cell form with but little intercellular substance being, as it is elsewhere, the most deadly of cancers.

It usually occurs tolerably early in life, between the twentieth and thirty-fifth years. I have seen one at eighteen years of age. It is chiefly distinguished by its smooth surface, more or less elastic feel, isolated position and mobility, and unusually rapid growth. The cutaneous veins are early enlarged, and the skin may give way so that a genuine fungation of the tumour results. It never, however, becomes incorporated with the tumour, which always has a distinct capsule. The axillary glands are long in being infected, but the more malignant kinds are prone to return again and again in and around the cicatrix after removal, and to be reproduced in distant organs, probably by way of the veins.

PROGNOSIS AND TREATMENT OF ADENOMA AND SARCOMA.

The only satisfactory proceeding is removal. As regards pure adenomata we do not know enough about them to say much. The probability is, that if thoroughly removed they do not return. Adenofibromata should be removed alone, leaving the breast untouched; and their recurrence need not be anticipated. If an adeno-cystoma be of any size the whole breast should be taken away. I have twice had recurrences of such tumours in pieces of breast left at the time of the first operation, but in both cases permanent cure resulted after every particle of breast was swept away. As to adeno-sarcomata and sarcomata, the whole breast should invariably be removed in such cases, and any skin also that may seem to be too near the tumour. The proposition to bring the microscope into use in the theatre to determine the nature of the tumours while the operation is proceeding will, I fear, never be of much practical use to the surgeon. When removing a breast tumour his most simple rule is to remember that if it is hard, lobulated, and slow of growth, it is probably innocent; while if it is smooth, elastic, succulent, and of rapid growth, it is certainly more or less malignant.

CARCINOMA.

It is to this form of malignant disease alone that many writers restrict the term cancer. The word, however, has no anatomical significance. It is strictly clinical in all its bearings, and, moreover, is not a mere surgical term, but is, and always will be, a term understood by the people at large, as having exactly the significance which a surgeon gives to the word malignant. It seems, therefore, most reasonable to consider carcinoma not as *the* cancer, but simply as a variety of cancerous or malignant disease.

Predisposing and exciting causes of mammary carcinoma.—As regards the influence of *heredity* and *locality*, these are discussed under the general heading of cancer. But it may be said that at present decidedly less importance is attached to the question of heredity than was previously the case. On the other hand, *traumatism*, formerly much scouted, has been shown to be not unfrequently a distinctly exciting cause. The testimony of patients as to blows or injuries being the starting point of their disease is, of course, very unsatisfactory, insomuch that no statistics upon the subject are of much value, but there is nevertheless a strong belief that they are often right. Although less clear of proof, there is good reason for believing that chronic induration, left after acute mastitis or abscess, may play a part in producing carcinoma, while chronic eczema of the nipple has been indubitably shown to be a precursor of it in many instances. In short, as in other parts of the body, prolonged irritation of any kind in or about the breast of a woman between thirty-five and fifty years of age is a distinct source of danger.

General microscopic appearances of carcinoma.—Carcinoma is anatomically an atypical, epithelial neoplasm, so that it belongs to the great group of the epitheliomata, as opposed to the sarcomata. It possesses a fibrous framework or stroma, the alveoli of which are occupied by cells. The fibrous stroma is probably formed in part from the pre-existing breast connective tissue, and is partly of new origin. The cells, as a whole, bear the features of spheroidal or glandular epithelial cells, but they are of every size and shape (polymorphous). At one time it was believed that they were characteristic, but this is quite wrong. There is no characteristic "cancer cell." Whence it follows that no mere scraping from the surface of a supposed carcinoma will suffice absolutely to determine it. Nothing short of a properly stained section from a properly hardened piece of the tumour will do this; unless, indeed, the examiner be a man of much experience in surgical pathology. We must not merely examine the cells, but the cells and the stroma, and their exact relations to each other as well. The cells have a certain amount of serous fluid around them, but no genuine cement material. They assume in sections the form of circular groups or cylinders or irregular masses, according to the shape of the alveoli and the way in which they happen to have been cut. As carcinoma is a growth which does not retain the type of the original gland structure (atypical), an important means of distinguishing it from adenoma, which does retain the gland type, is that in the former the cell plugs are solid and there is no membrana propria, so that the cells freely infiltrate the general connective tissue, whereas in the latter the cell plugs very generally have a central lumen, and rest upon a distinct membrana propria, which limits them.

Varieties of carcinoma.—From the fact that carcinoma is partly fibrous and partly cellular in its construction, it comes about that there are two main divisions of the growth, according as one or other of its constituent elements happens to predominate. When the fibrous element predominates it is excessively dense and hard. Hence it is termed *fibrous carcinoma*, very commonly called *hard carcinoma* or *scirrhus*. When the cellular element predominates, it is succulent and elastic, whence it receives the name *cellular carcinoma*, or *soft carcinoma*, or, from the appearance of its section, *cerebriform*, *medullary*, or *encephaloid* carcinoma. It would be well if the multiplicity of names could be done away with, and the terms fibrous and cellular carcinoma alone employed, as they would at once indicate both the clinical and the anatomical features of the two varieties. They gradually run into each other without any definite limitation, so that artificially to make varieties of them can serve no good purpose.

Microscopic appearances of fibrous and cellular carcinoma on section.—A mass of fibrous carcinoma (scirrhus) cuts under the knife like a piece of cartilage, almost with a creaking sound. The cut surface feels tough and impenetrable to the finger, and at once becomes somewhat concave. A creamy turbid juice can be scraped from it. Its colour is of a greyish white with a certain glistening aspect, and dispersed throughout it are small yellow dots and streaks. It is exactly like a slice of the thick end of an unripe winter pear. These dots and streaks represent cell columns in process of fatty degeneration. Sometimes there are little collections of a thick, white, milky fluid, which is clearly mammary secretion pent up in partially obliterated ducts. There is no definite limit whatever to the morbid structure, but it shoots into all the nearest tissues and infiltrates them, so that at its margin may be found fragments of muscle or little islands of fat surrounded by the disease.

A cellular carcinoma (encephaloid) varies in appearance according to the amount of cells in it. If these are not very excessive, the knife cuts it more easily than the fibrous form, while its surface does not become concave, and the exuding juice is more abundant. It is not grey, but white in colour, while scattered about are patches where softening or blood infiltration are going on. When the cells are in great abundance and the fibrous tissue reduced to a minimum, then the section has the brain-like appearance from which the name cerebriform or encephaloid was obtained. Its surface is somewhat of a pinkish hue with areas of broken-down material, and often large blood effusions and coagula.

General characters of fibrous or hard carcinoma (scirrhus).—A fibrous carcinoma is of an irregularly rounded shape, somewhat nodular, and intensely hard to the touch. It has a stony hardness and weight, which is not possessed by any other mammary tumour, and which is eminently characteristic. It has no definite circumscribed outline, but merges into the healthy gland tissue. At first it is quite movable, but, as it grows, it adheres to the skin, and afterwards to the great pectoral muscle, so that it becomes immovably fixed to the chest wall. Its early growth is slow, and, speaking generally, it does not attain a great size as compared with most other mammary tumours. There are instances, fortunately not very numerous, where the disease does not commence, as just described, in the form of an isolated movable lump, but as a general infiltration of the whole gland.

The most frequent *site* of fibrous carcinoma is without doubt the upper and outer quadrant of the gland towards the axilla, and after that immediately beneath or close to the nipple. Very rarely indeed does it commence low down on the inner side of the gland.

Adhesion of the skin is most characteristic of fibrous carcinoma. Doubtless the skin also adheres to inflammatory growths and even to simple tumours, but then it is always of a glazed appearance, thinned, and stretched before an ever increasing and advancing subjacent mass; whereas in fibrous carcinoma the growth lays hold of the skin from below and pulls it down to itself. It tucks in the hair follicles and the fibrous bands which pass from the under surface of the skin to the mammary fascia, and thus produces a delicately pitted appearance, which exactly resembles the pig skin of which a saddle is made.

Retraction of the nipple and discharge therefrom.—Even simple tumours may push the nipple on one side or almost bury it, but by the retraction caused by fibrous carcinoma is meant a distinct pulling in of the nipple so that it looks like a depressed umbilicus. Naturally this can only occur when the disease is situated just below the nipple, so that while its presence is strongly indicative of fibrous carcinoma, its absence is of no moment if the tumour be situated at any distance from the nipple. Grave errors have been committed by assuming nipple retraction to be an essential feature of carcinoma. Its value simply depends upon the site of the disease. In some instances (but not many), where the disease is close to the nipple, there exudes from the latter a thin discharge. It is generally, however, light in colour and very small in quantity, which distinguishes it from the copious, coloured discharge which sometimes occurs in certain forms of cystic disease.

As regards *pain*, there is none in the commencement of carcinoma. When the tumour has attained such a size as to be distinctly perceptible, the patient's attention is generally attracted to it by slight pricking or shooting sensations, but often the first discovery is purely accidental, made perhaps in the act of washing. For the most part the growth itself is not painful to the touch, and can be gently handled without giving distress. From the absence of pain patients often comfort themselves with the idea that their disease cannot be cancer, but, in making his diagnosis, the surgeon must be upon his guard never to be led away by this fallacy. On the other hand, in the later stages of the disease, and particularly when the enlarged glands have grasped the brachial plexus, the pain is agonising and almost without cessation. It is one of the chief agents in literally wearing the life out of the unhappy victim of cancer.

Very erroneous notions are prevalent as to a general *cachectic condition* of the patient being an essential accompaniment of cancer. Of course, when months of mental anxiety, physical agony, and perhaps exhausting discharge, have done their work, the patients are cachectic enough, but it can hardly be too strongly impressed upon the student that the subjects of mammary cancer are, for the most part, healthy persons, and are often never in better condition than when the disease first makes its appearance. I think I have noticed that robust, squarely-built women, with dark hair, slightly sallow aspect, and thick skin, are among the most common subjects. As evidence of the generally healthy type of cancerous patients, Mr. Nunn showed by statistics that their parents and grandparents were noted for their more than usual longevity.

A most important guide in the diagnosis of fibrous carcinoma is the *age of the patient.* The following table of 642 cases given by Gross shows this at a glance :

18	first appeared	between	20	and	30	years of age.
128	,,	,,	30	,,	40	,,
245	,,	,,	40	,,	50	,,
165	,,	,,	50	,,	60	,,
78	,,	,,	60	,,	70	,,
8	,,	,,	70	,,	80	,,

Henry records a case of fibrous carcinoma at 21 years of age, and Sibley one at 26. I have myself operated upon one case at 26, commencing towards the end of pregnancy. It was diagnosed mainly by the pig-skin appearance of the integument over the tumour. Agnew has seen fibrous carcinoma at 100 and 107 ; but the most dangerous time is certainly from 45 to 50, while up to 30 years of age fibrous carcinoma may almost be put out of the question in a matter of diagnosis. Statistics are not very clear as yet as to the relative frequency with which the disease affects married or unmarried women, or as to the relations between those who have and those who have not borne children.

MODE OF EXTENSION, ULCERATION, AXILLARY AND OTHER SECONDARY DEPOSITS.

A fibrous carcinoma or scirrhus, if left untouched, gradually but steadily increases, invading the skin and the mammary tissue until the gland almost disappears, and becomes converted into a stony nodular mass with a depressed nipple, which in time adheres immovably to the pectoral muscle. After awhile the morbid elements find their way along the peri-vascular sheaths of the vessels of the skin, and are deposited at intervals, where they grow and form *shot-like bodies* which develop into larger tubera. Sometimes the disease spreads very extensively through the skin after this fashion, invading the whole chest wall, and, by its contraction, so tightening it and rendering it rigid, that the greatest difficulty in breathing is experienced. This the French call cancer *en cuirasse.* Often when this occurs a red blush, like that produced by a mustard leaf, spreads over the affected area.

Sometimes *ulceration* takes place, occasionally superficial, but at other times forming deep, excavated cavities, with hard, irregular, and everted edges. There is never, however, any fungation. From the ulcerated surface exudes a thin, foul, ichorous discharge, often bloody. At times vessels in it give way, and hæmorrhages occur which may even endanger life, from their suddenness and severity. They are easily stopped, however, by the least pressure, if well directed.

Very early in the course of the disease the *axillary glands* are infected, long before any enlargement in them can be made out by the finger, unless the patient be extremely thin. The pathological changes which occur in the glands are exactly similar to those in the parent mischief in the mamma. As they enlarge, the glands lay hold of the axillary vein and the brachial nerves, compressing them and stopping the circulation in the vein, so that the arm becomes intensely swollen. It feels like lead, utterly helpless, and with exquisite shoots of pain thrilling along it. From the armpit the disease creeps along the lymphatic vessels (which can be seen like thrombosed white threads when the axilla is opened) to the glands of the neck.

In time *secondary deposits* take place in other organs, most frequently in the liver, next in frequency in the lungs and pleuræ, and next in the bones. The femur and ribs are often infected, and very often, too, the vertebræ, in which, when it occurs, the disease produces all the phenomena of acute angular curvature with paraplegia.

CELLULAR, SOFT, OR ENCEPHALOID CARCINOMA.

As has been stated, the essential feature in this form of carcinoma consists in the excess of the cellular over the fibrous element. This implies active growth, and, as a consequence, we find the disease occurring earlier in life than the fibrous or scirrhous form, and running its course with much greater rapidity. Its malignant or infective characters are also much more pronounced. It commences as a round, movable tumour, usually more deeply seated than a fibrous carcinoma. Growing often with frightful rapidity, it may reach the size of a fist or of a child's head in a month or two, attaining much larger dimensions than the fibrous variety ever does. It has a knobby feeling, but not the stony hardness of scirrhus. Indeed, it is more usually slightly elastic, and at points presents a most deceptive feeling of fluctuation. At first it merely pushes the skin before it, but soon it adheres to it. Often the integument over it becomes red and œdematous, producing a most deceptive resemblance to abscess. After a time it thins and gives way, and ulceration sets in. Pieces of the disease may become detached, but there is no true fungation. For a long time the pain is very slight, but the general cachexy makes its appearance much sooner than in fibrous carcinoma. The glands and the distant organs in due course become infected, and the patient dies worn out. As Agnew puts it, "The great size, rapid growth, and comparative softness of the tumour, the absence for a long time of severe pain, and the early constitutional involvement, will always serve to distinguish it from other carcinomatous diseases of the breast." But its resemblance, in bad cases, to malignant, round-celled sarcoma is very great, and doubtless until very recently the two have been much mixed up. The grand distinction is that the cellular carcinoma is an infiltrating growth without definite limits, whereas the sarcoma is a distinctly circumscribed and encapsuled tumour.

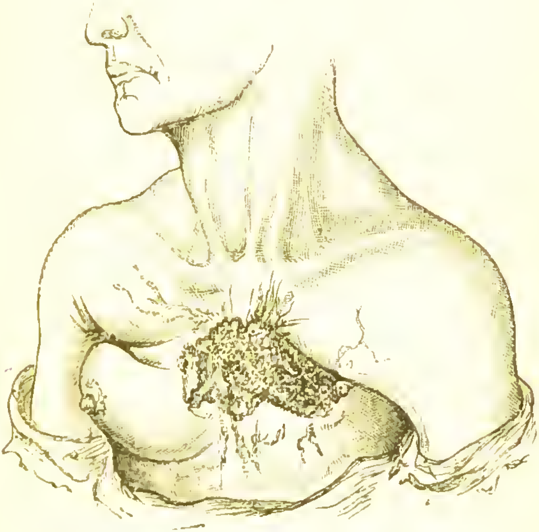

Fig. 33.—Atrophying Scirrhus of the Breast.

MINOR VARIETIES OF CARCINOMA.

In fibrous carcinoma the epithelial elements, in a few instances, becoming fatty and granular, undergo absorption, while the fibrous elements increase greatly in bulk, and become sclerosed and almost tendinous in consistence. As a result, the growth becomes contracted into an indurated mass of hard fibrous tissue, from which this variety receives the name of **atrophying or withering scirrhus** (Fig. 33). This form often remains quiescent for long periods, and patients may live for many years with it. Nevertheless, although the original portions of the disease may undergo a sort of spontaneous cure, it still spreads and infects the glands and distant organs in the same way as the more acute forms, and ultimately is always fatal.

Combined both with fibrous and cellular carcinoma are found various forms of **cysts,** very often of the simple retention variety produced by obstruction of the terminal acini and ducts. Moreover, some rapidly growing carcinomata, particularly those occurring during pregnancy, undergo inflammatory changes in their connective tissue elements leading to the formation of distinct, although comparatively small, abscesses. The presence of cysts or abscess is very apt to add difficulty to the diagnosis. Again, **colloid** changes take place in carcinomatous tumours, but this is so rare an occurrence as almost to constitute a surgical curiosity. Diagnosis before removal is practically impossible. One feature is that colloid carcinoma grows very slowly indeed, and seems to take a long time to infect the glands, so that removal is hopeful.

TREATMENT OF CARCINOMA.

It may at once briefly be stated that all the internal remedies and local applications which have hitherto been tried for the cure of carcinoma (and their name is legion) have been, to all intents and purposes, practically useless. There are only two plans of procedure: either to leave the disease entirely alone and employ palliative and soothing measures, or promptly to extirpate it with the greatest thoroughness.

Palliative treatment.—The patient should cease to employ the arm on the affected side, and should wear it in a sling. Every movement of the arms involves movement of the great pectoral muscle upon which the tumour rests. Stays or other portions of dress which in any way irritate the disease should be left off, and the breast itself carefully supported. Belladonna and other sedatives applied locally give a little relief, but in the end the surgeon has to fall back upon opium in one form or another; and, if there exist cases in the whole category of disease in which it is allowable to give sedatives in a lavish way, cases of cancer are they. When the disease is allowed to run its course unchecked, it is reckoned that the average duration of life in fibrous carcinoma (scirrhus) is about two and a half years. Of course there are cases where death occurs much sooner, but there are probably more which exceed that limit, and in which the malady may take several years to prove fatal, remaining at intervals quiescent for long periods. In cellular carcinoma (encephaloid) the progress is much more rapid, and the patient seldom lives more than from six to twelve months from the commencement of the growth. Without doubt the younger and more vigorous the patient, the more rapid is the course of the disease; while the slowest progress is to be looked for in very old, thin subjects. Of all conditions, pregnancy exercises the most stimulating effect upon carcinoma, and those terrible cases which sometimes run their course in a few weeks usually commence at this time.

The general question of operation.—Operative measures should never be undertaken when they manifestly involve excessive risk to the patient's life, or when the surgeon cannot see his way to a complete and thorough removal of all diseased parts visible to the naked eye. He must remember that he has not merely to consider the patient immediately under his care, but that he must on no account do anything which shall prejudice the operation of removal in the eyes of the public. The unsatisfactory result of a single case may turn many women against having their breasts removed, whose cases might have been eminently suitable for operation, and who might have thereby saved their lives.

It may safely be said that the system which has so long prevailed in this country of partial and incomplete removal, involving, as it always has done, the horrors of a recurrence of the disease even more dreadful to bear than the original evil, has been the great cause of the unpopularity of the operation. It has deterred innumerable patients from disclosing their disease until pain and distress brought them to that frame of mind that they would submit to anything in the hope even of temporary relief. By that time it is too late to make a complete extirpation. If patients could only be induced to seek advice about their malady and to submit to operation so soon as any mischief whatever is discovered in the breast, and before serious infection of other structures has taken place, permanent cure would be very much more common. But this they will never do, so long as it is commonly believed by the public that operation is only to be had recourse to as a *dernier ressort*, with practically the certainty of a speedy return of the disease.

Long experience alone can produce reliable judgment on the matter of when to operate and when not, but certain broad principles can be laid down. Extensive infiltration of the skin with small shot-like bodies or tubera is a serious obstacle. It is the condition of all others from which local recurrence is most to be dreaded, and, unless it is possible to leave a wide margin of skin beyond the smallest and extremest of these bodies, it is no use operating. It cannot be too often repeated that the smallest particle of disease left behind is as deadly as a large mass. Extensive affection of the axillary glands is a strong deterrent, while invasion of the cervical glands by the mischief is an absolute bar to the use of the knife. The liver, lungs, bones, and uterus, should be examined, if possible, before operating, as nothing can be done if disease is found in them. Again, in persons who have nearly attained the end of a long life, say approaching seventy, it is to be expected that the growth of the disease will be slow, while a severe operation necessarily involves the utmost risk. Many old women live for a considerable time after the discovery of breast cancer, have very little suffering from it, and die apparently from some other malady. Unless earnestly requested by the patient, the surgeon will do well to refrain from operation where the sands of life have already pretty nearly run out.

On the other hand, given a healthy, middle-aged subject, with a movable tumour of no great size, and but little affection of the glands and skin, then a sweeping removal will in a large number of such cases be found to be permanently curative. It is pretty generally admitted, that while certain persons have a distinct cancerous tendency or diathesis, most cancers are local, and kill by being allowed to infect neighbouring parts too freely before removal, so that if the very first germs of the disease could be made out and freely removed, immunity from return would nearly always result. The view that partial operations prolong life and give relief is perfectly erroneous. The local excitement and irritation, which ensue after operation and during the healing of the wound, have always appeared to me only to stimulate the remaining disease to more rapid growth. The worst arms I have ever seen have been those where the breast was removed and the axillary glands left behind to grow.

Removal of the breast and axillary glands.—In order to avoid a cutting operation, the breast has been removed by the écraseur, by the thermo-cautery, and by caustics of various kinds, such as Vienna paste, chloride of zinc arrows, and sulphuric acid with lampblack. There is no possible advantage in these plans for any ordinary case, and the pain produced is worse than that caused by the knife. Furthermore the dread of the latter (which is the only real excuse for resorting to other methods) is rapidly dying out, now that anæsthetics are universally used.

There are no special rules for removing the breast by dissection. The one thing to be aimed at by the surgeon is thoroughly to uproot every particle of disease, cutting always well into sound tissues. Selecting the central part of the growth, he should plant his incisions around it according to circumstances, so that all suspicious skin may be removed without any heed being taken for the manufacture of flaps to close in the wound. If the skin remaining after the operation will close in the gap, so much the better. If it will not do so, then tension button stitches may be used to pull everything together as far as possible, while the rest must be left to granulate over like any open wound. The fascia over the great pectoral muscle should always be carefully removed along with the breast and any pieces of muscle to which the tumour may have become adherent.

Having quite cleared away the diseased breast, I make a point of at once bringing together the wound so made, as far as possible, and protecting it with gauze, being satisfied that many cases of pleurisy and pneumonia are caused by the prolonged exposure to cold of the lung, for the time covered only by ribs, intercostals, and pleura.

After this an incision should be carried into the axilla about one and a half to two inches below the edge of the great pectoral. The axillary fascia being opened, the knife should at once be laid aside, and the armpit cleared out with the aid of two pairs of very strong broad-pointed forceps and a dissecting tool. The first thing to do is to lay bare the axillary vein, after which there is no risk in removing the glands. Should these be adherent it is better not to run the risk of tearing the vein, but to tie it above and below the disease and remove the affected part. I have twice removed portions of the axillary vein, and have on another occasion tied it in two places, and have not found the least mischief arise from doing so, not even œdema. It is this fact which has often made me doubt whether the swelling of the arm from enlarged axillary glands is entirely due to mechanical pressure on the vein or not. When it can be done I bring together the whole operation wound, inserting a large drainage tube at the highest point in the axilla. Then I make an artificial drainage aperture at the lowest point of the cavity, about half-way down the axillary region, and insert another large tube. For some days after the operation I employ new sponges wrung out of an antiseptic lotion as a dressing, finding that they provide excellent compression for the wound cavity, while rapidly and effectually sucking up all discharges.

It will be observed that I advocate removal of the axillary glands as an invariable accompaniment of removal of the breast, a doctrine which I have taught and acted upon for the last ten years. To say that the glands are not affected, because one cannot feel them enlarged, is a great error, as I have demonstrated over and over again in fat subjects in whom not a gland could be discovered till the axilla was opened, and then plenty were found in various stages of infection. I am aware that this is taking an advanced view of the question, and am prepared to admit that the mortality after this operation will be serious, probably 15 per cent. ; but

I am equally convinced that it is the only plan by which immunity from return of the disease can reasonably be looked for. Hitherto partial and incomplete operations have been worse than useless. They have saved no lives, and they have destroyed the confidence of the public in surgery as a permanent means of cure. The plan just recommended will be fatal to a certain number of persons, it is true, but it will save the lives of many more.

Cysts.—Mere cysts of the breast are carefully to be distinguished form cystic tumours, by which are meant tumours primarily solid in which cysts are subsequently developed. All breast tumours may have cysts form in them; but those in which they most frequently occur are the adenomata or adeno-fibromata and the sarcomata. Very rarely do they arise in carcinomata. These cystic tumours have been referred to more fully under the head of adeno-cystomata.

Retention cysts.—1. *Milk cysts*, or *galactoceles*, are by no means common. Nearly always they are found close to the nipple, and arise from dilatations of the large milk ducts in that region, produced by obstructions in some part of their course. They are almost invariably single, usually appearing during the period of lactation, and increasing rapidly in size. They are painless, soft, fluctuating swellings, having the cutaneous veins over them generally much dilated. Sometimes their contents become semisolid, or cheesy.

2. *Glandular cysts.*—These seldom arise in the large milk tubes, but take origin in the smaller ducts or in the acini. They may be single, or there may be several in connection with a lobule of mammary tissue, which has its main efferent duct partially or wholly occluded. Sometimes, indeed, the whole gland is full of them. When the occlusion is not quite complete, the contents of the cyst or cysts escape at the nipple, usually in the form of a copious sero-sanguineous

discharge. They are of every size, from that of a mere millet seed up to such as will contain a pint of fluid; but they usually come under observation when about the size of a walnut. The contained fluid is very commonly straw-coloured, but may be brown and turbid, or even bloody. The cysts are lined by a distinct epithelium, which frequently serves as a starting point for proliferating intracystic growths of a papillomatous character. They are almost painless, slow of growth, and never form adhesions, while the age of the patient is usually between thirty-five and fifty. They are smooth in outline, and with a certain elasticity, but distinct fluctuation is seldom to be made out, and, when very tense, they have so solid a feeling that they are often mistaken for early carcinomata, if deeply buried in the gland tissue. In fact, the diagnosis of not a few cases can only be made certain by the use of an exploring needle, so that if, in the mind of an operator, there should be any doubt at all as to the nature of a tumour presumed to be a carcinoma, he should cut into it before sweeping away the whole breast, lest it should turn out to be merely a cyst.

3. "*Involution cysts*," as they are termed, occur in the mammæ of females past middle life, as a result of degenerative changes. For the most part they are small and numerous, and give rise to hardly any discomfort, so that they are often never discovered during life. Occasionally, when one or two of them attain some little size, they are most difficult to diagnose from cancer.

Connective tissue or lymph space cysts.—These cysts, which only differ in some minor points from the ordinary glandular cysts just described, are believed not to arise in glandular tissue as the result of retention, but to take origin in the interfibrillar lymphatic spaces of the connective tissue.

They are, therefore, not "serous" cysts, but "lymphatic" cysts in point of origin (Butlin).

Treatment of cysts.—Small thin-walled cysts may sometimes be cured by mere tapping, or they may be laid open and packed so as to make them granulate up. But if large, or if there are two or three together, excision is undoubtedly the best plan; and if, in the process of so doing, it should be found that the breast is studded with others evidently in process of growth, the whole gland had better be removed. This is recommended, not so much from fear of any tendency to malignant degeneration but from the dread which recurrent tumours excite in the minds of patients. The so-called "involution cysts" of old persons need not be interfered with, unless causing decided annoyance.

X INJURIES AND DISEASES OF THE FEMALE GENERATIVE ORGANS.

FREDERICK TREVES.

THE VULVA.

Urethral hæmorrhoids or **caruncles.**—These little growths are met with at or near the meatus; they never exceed the size of a pea, and are generally pedunculated. They are of a bright red colour, are a little lobulated, and very friable. They usually protrude from the meatus. They may be met with at all ages, but are most common in women who have reached the climacteric. They usually, after a time, cause much pain, especially on micturition, and are apt to bleed. The little tumour should be well exposed and excised by the scissors together with the patch of mucous membrane from which it grows.

Hæmatoma vulvæ.—This term is applied to an extravasation of blood in the substance of the labium majora. The texture of that part being lax, tumours of large size, often the size of the fist, may result from subcutaneous hæmorrhage. In extreme cases the hæmorrhage may extend even to the pelvis. The extravasation usually results from injury, especially during pregnancy, or parturition. It is said also to occur spontaneously from the rupture of varicose veins. The effused blood is usually absorbed in time. It may, however, become encysted, or may induce suppuration.

Ice should be applied for thirty-six hours, and if at the end of that time the swelling has ceased to increase, warm applications should be used to promote absorption. In no case should the collection be evacuated, for although it may persist for a long time, it will in the great majority of cases disappear in due course. If it forms an abscess, or blood cyst, the swelling must be treated upon the principles applied to like swellings in other parts.

Vulvitis.—Acute vulvitis may result from uncleanliness in the unhealthy, or may follow severe cold, injury, or discharges from the internal genitals. It is most usually the result of gonorrheal infection. It is said that in children, vulvitis may result from the entrance of the oxyuris into the vulva, the worm having escaped from the anus. The swelling of the parts most conspicuously affects the nymphæ. The treatment consists merely in affording rest to the part, in removing any exciting cause, in strict cleanliness, frequent bathing, and the use, first of all, of permanganate of potash lotion, and then of some astringent solution.

Vulvar folliculitis affect the labia majora, the external aspects of the nymphæ and the genito-crural folds. It is limited to the sebaceous glands and hair bulbs of the part. The labia are red, swollen, and tender, and the parts present small red elevations, produced by inflamed sebaceous glands and hair follicles. These enlarge, suppurate, and burst. Much erythema and œdema result, and there is a copious and offensive discharge. The condition may lead to abscess. The parts must be kept scrupulously clean, and be frequently bathed with some weak antiseptic lotion, and the labia should be kept apart by pads of cotton wool soaked in glycerole of tannin or of borax.

Phlegmonous inflammation of the vulva may follow infected wounds, especially those inflicted during labour.

Gangrene of the vulva may occur in adults as a result of protracted labour, of small-pox, typhoid or typhus fever, and cholera.

Noma.—This term is applied to a gangrenous inflammation of the vulva, that resembles, in its pathological and general clinical characters, cancrum oris. It is met with in weakly, cachectic, and ill-fed children. It may follow injury, but most usually appears spontaneously as a sequela of one of the eruptive fevers.

Upon one of the labia a red indurated spot appears; the induration spreads; the parts become swollen, œdematous, and of a dusky red colour. A foul discharge exudes; the child cannot walk for the pain; micturition and defæcation are painful, and the inguinal glands enlarge. The indurated parts soon become gangrenous, and the necrotic action extends rapidly. Symptoms of marked constitutional depression with a low form of fever set in early. There is often some diarrhœa, and in acute cases death may ensue from exhaustion, or from septicæmic manifestations, in seven days.

The child must be kept in the recumbent posture, with the thighs well separated. Iron should be administered together with small quantities of alcohol. As soon as the affection has been recognised, all the involved parts should be promptly and liberally destroyed with the thermo-cautery. With one thorough application the disease may be stayed. After the burning, the parts should be dressed with carbolic oil, and kept scrupulously clean.

Abscess of the vulva may result from injury, from severe vulvitis, or possibly from suppuration in an occluded mucous gland.

Suppuration of Bartholin's gland may be due to obstruction of its duct, or to extension of inflammation in severe cases of gonorrhœa, to injury, or to irritating discharges. The gland is placed at the commencement of the vagina, and measures about half an inch in its longest diameter. Its duct opens on the inner aspect of the nymphæ outside the hymen. An oval swelling appears at the site of the gland in one labium. It is red, tense, very painful and tender, and varies in size from a pigeon's to a hen's egg. It narrows the vaginal orifice, and upon pressure pus may ooze from the duct. There is much surrounding œdema, some catarrh of the mucous membrane, and possibly pain on movement. The swelling, if left to itself, will probably burst; but before that occurs the pus may burrow, and very troublesome fistulæ result.

The treatment consists in the general measures applied to suppuration, and in an early and free incision into the cyst. The cavity should then be dressed from bottom with lint soaked in eucalyptus oil.

Pruritus vulvæ is a symptom only. It is met with in connection with diabetes, gout, irritating discharges, uterine cancer, herpes, aphthæ, acne, eczema, scabies, etc. It is to be treated by the removal, so far as possible, of the cause, by the use of carbolic and other lotions, and frequent ablution.

In some intractable cases where much distress is occasioned, and where no apparent cause exists for the trouble, a ready cure may be obtained by the use of cocaine.

Tumours.—Certain tumours are met with in the vulva. They merely require to be enumerated, since in their characters and treatment they do not differ from like growths elsewhere. Elephantiasis is most usually met with between the ages of twenty and thirty. It mostly affects the labia majora, then the clitoris, and more rarely the nymphæ. It may form numerous tumours that in some cases have reached to the knee. Papillomata are apt to appear about the vulva as a result of irritative discharges, especially such as are venereal. Large and exuberant warty growths may develop, which may extend to the anus and thighs.

Cases of immense lipomata of the labia majora have been noted. Fibromata or fibro-myomata may develop in the larger lips. They are apt to become polypoid, to ulcerate, and in some instances have attained a great size.

Nævus is not uncommon in this part. Sarcoma is rare, and may appear as a tumour, as a warty growth, or in the form of melanosis.

Vulvar cysts.—These most usually have origin in the glands of Bartholin. Tense, elastic, painless, ovoid tumours, with thin walls, appear in the site of these glands. They often cause no inconvenience. Their contents are usually clear and serous, but may be glairy. They are readily treated by incision and subsequent dressing from the bottom. Dermoid and sebaceous cysts are also met with in this part.

Cancer.—Cancer of the vulva takes the form of epithelioma. It usually begins in the nymphæ, often in the clitoris, and sometimes in the labia majora. It is met with, as a rule, in the middle-aged or elderly. It grows rapidly, ulcerates early, and soon affects the inguinal glands. It presents the usual characters. No treatment is likely to be of any avail except a very free extirpation with the cautery as soon as the disease has been recognised. When once the cancer has extended beyond a patch of moderate size, even an apparently very free removal is commonly followed by a speedy recurrence.

Chronic destructive ulcers of the vulva.—In addition to epithelioma, three forms of destructive ulcer may be met with in the vulva, viz. lupous ulcer, tertiary syphilitic ulcer, and scrofulous or tubercular ulcer. These ulcers, when met with in this part, present all the characters of similar sores found elsewhere, and they can be distinguished from one another by the features described in a previous article (Art. V., vol. i.). The last-named ulcer requires some notice, since it has been very elaborately described by French surgeons under the name of "*esthiomène*," or "*scrofulide maligne de la vulve.*" This sore differs in no way from the scrofulous or tubercular ulcer. It is met with in strumous or tubercular individuals, and is most common on the labia. It may begin by reddish tubercles, which break down, fuse together, and form an irregular spreading sore, with thin, purple, flat, and undermined edges, with an irregular base. Such ulcers can usually be cured by attention to the general health, by the use of cod-liver oil and iodide of iron, and by the local application of the thermo-cautery, followed by an iodoform dressing.

THE PERINÆUM.

Rupture of the perinæum.—This accident is not uncommon after first labours. The degree of laceration may vary from a slight tear of the fourchette to a rent that extends into the rectum and divides the sphincter. The slightest forms of rupture cause no trouble, and require no operative treatment. Ruptures involving the greater part of the perinæum not only give rise to a distressing sense of weakness and of loss of control over the parts, but also encourage prolapses. This most usually takes the form of *rectocele vaginalis*, a term applied to a prolapse of the posterior wall of the vagina, together with such part of the rectum as is in contact with it. Another form is the *cystocele vaginalis*, when the anterior vaginal wall with some part of the bladder is prolapsed into the vaginal orifice, or there may be in severer cases more or less prolapse of the uterus. When the sphincter has been ruptured there is, in addition to these troubles, incontinence of fæces.

In performing any operation for the restoration of the perinæum, it must be borne in mind that the term perinæum applies not merely to the skin between the vagina and anus, but to the whole of the recto-vaginal septum. This septum appears, on median section, in the form of a triangle with its base at the integument and its apex high up between the rectum and the bladder (Fig. 34). A mere restoration of the skin of the perinæum is useless.

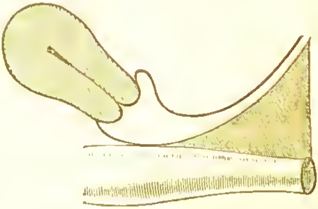

Fig. 34. — Diagram of the Perinæum (Stimson).

If the patient should be seen immediately after the rupture has occurred, steps may be taken to close the fissure at once. Such attempts will probably fail, owing to the bruising of the parts, the patient's health, and the vaginal discharge incident to parturition. They may, however, succeed, and in event of failure can do no harm. If immediate closure has not succeeded, or has not been carried out, the operation should be postponed until the patient's health is thoroughly restored, until all vaginal discharge has ceased, and, if possible, until after she has ceased to suckle the child. The rectum having been well cleared out, the patient is placed in lithotomy position, and the parts well exposed. The first step of the operation is to freshen the surface, which is done by dissecting off the mucous membrane. This dissection should extend well up along the floor of the vagina in the median line, and the bared area, if measured along this line should be from an inch to one and a half inches. The bared surfaces on either side of the median line will be of triangular outline. The bleeding having been checked, the sutures are introduced by means of a large Hagedorn's needle held in a holder. The hindmost suture is introduced first. The sutures must be passed deeply so that no part of them is exposed upon the bared surface. They must be introduced also at least one inch from the margin of the wound. The best material is Chinese twist, and the ends may be secured after the manner known as "the quill suture," or by means of split shot, or, as some prefer, by merely tying in a knot. Three deep sutures will be sufficient, as a rule. The rest of the wound should be carefully closed by surface stitches of fine silk.

When the sphincter is involved, its divided ends must be united with care, to guard against two common evil results of imperfect closure: recto-vaginal fistula, and continued incontinence of fæces. Dr. Thomas advises that the suture that unites the sphincter should be applied as follows: Enter the needle as low down as the lower edge of the anus, pass it thence upwards through the recto-vaginal septum, completely encircling the rent, and bring it out alongside the lower edge of the anus on the other side. Its action then is like that of a purse-string, puckering up the open parts and restoring the sphincter to its original ring-like outline. After the operation the bladder should be emptied by catheter only for the first five or six days. The bowels must be kept from acting, complete rest in the recumbent posture must be insisted upon, and the parts be kept very clean. The deep sutures may be removed on the sixth or seventh day, or before, if they are exciting suppuration. The surface stitches may be left in a little longer. At the end of ten days the bowels may be opened by enema, but the patient should, in any case, not leave her bed for three weeks after the operation. When a rectocele or cystocele exists, it is well at the time of the operation to remove an elliptical piece of the mucous membrane that covers the swelling, and then carefully close the gap with many points of fine silk suture.

THE VAGINA.

Acute vaginitis.—This affection may follow injury, exposure to cold, the use of irritating injections, or the introduction of foreign bodies. It may occur spontaneously in children after the acute exanthematous fevers. Its most common cause, however, is, without doubt, gonorrhœa.

The mucous membrane is seen to be red, soft, and swollen, the vaginal folds are peculiarly prominent, the surface may bleed. Secretion is at first diminished, but soon becomes increased, is copious, and muco-serous or muco-purulent in character. The parts are tender and painful; there are pains about the perinæum, pain on defæcation, and often stranguary or tenesmus. The affection may last for weeks, and may become chronic. It may extend, especially the gonorrhœal form, to the urethra, or lead to suppurative inflammation of Bartholin's glands.

The inflammation may extend to the uterus, and thence to the Fallopian tubes (endometritis, pyo-salpinx). It may lead to ulceration of the vagina. Ulcerative inflammation at the upper part of the canal may cause the cervix to adhere to the vagina, and so obliterate the vaginal cul-de-sac.

Treatment.—Rest in the recumbent posture, the liberal use of saline aperients, frequent warm hip baths. The local treatment may be commenced by the use of warm injections of permanganate of potash lotion (thirty minims of liq. potass. permang. to one ounce of distilled water). When the acute symptoms have moderated a little, lotions of acetate of lead or of alum may be employed, and at a later period still the inflamed membrane may be treated by plugs of wool soaked in glycerole of tannin. Pain may be relieved by morphia suppositories.

Leucorrhœa in children.—This somewhat common affection has attracted no little attention from the circumstance that it has been frequently mistaken for gonorrhœa, from which mistake legal complications have arisen.

The disease is essentially a severe form of chronic catarrh of the mucous membrane. It is usually met with in scrofulous children, and is most common between the ages of two and eight. It is well known that catarrhal inflammations form one of the most striking features of the strumous diathesis, and there is no reason why the mucous membrane of the genitals should be exempt. The immediate cause of the trouble may be dirt, or injury, or exposure to cold, or it may occur in connection with disturbances of health incident to dentition or to the eruptive fevers.

The trouble is usually chronic from the first, is apt to persist, and to relapse after apparent cure.

The labia are swollen and red, the parts tender and painful, the child complains of a burning and itching about the vulva. There may be difficulty in walking, and scalding on micturition. The discharge is profuse and muco-purulent. Examination shows that the mischief is almost entirely limited to the labia majora and minora and the anterior surface of the hymen. The vagina is very seldom involved to any extent, nor does the mischief spread to the urethra.

Treatment.—Strict cleanliness must be enforced, the bowels kept open, and tonics, with iodide of iron and cod-liver oil, should be administered. The parts should be frequently bathed, and well irrigated several times in the day with a weak alum lotion. When the discharge has diminished, the parts may be dressed with a bismuth and zinc ointment (oxide of bismuth forty grains, oxide of zinc twenty grains, vaseline one ounce), or with an ointment containing boracic acid.

Wounds of the vagina, even when slight, are apt to bleed very freely, especially during pregnancy. In most cases the bleeding may be stayed by rest in the recumbent posture, with the pelvis raised, by a careful plugging of the vagina, and the application of ice to the vulva and perinæum. In severer cases the plug may be composed of lint steeped in perchloride of iron, or the bleeding point may be touched with the thermo-cautery. In the most intractable cases acupressure has answered well, although the needle is not always very readily introduced.

Foreign bodies in the vagina have in certain instances been retained for years without exciting any conspicuous trouble. Usually, however, a profuse leucorrhœa results from their retention, abscesses may form, and vesico-vaginal and vagino-rectal fistulæ may be produced. The foreign bodies are very commonly pessaries or portions of pessaries, the removal of which has been overlooked. A remarkable series of foreign bodies, however, has been placed on record in connection with the vagina. Among them may be mentioned hair-pins, pencils, pebbles, needle-cases, and the like. Schrœder concludes an enumeration of such foreign substances with this remark: "Probably the strangest foreign body ever discovered in the vagina was one found by me: a cockchafer lying beside a pomade pot!"

Solid tumours of the vagina are very rarely met with. Cases of fibromata and of sarcomata springing from the fibrous coat of the vagina or from the connective tissue outside it have been recorded. Most of the sarcomatous growths of this part are secondary. These solid tumours may attain large size, may be sessile or become polypoid, may ulcerate and lead to copious hæmorrhage. When large, they cause great discomfort by pressure, leading to deviation of the urethra, narrowing of the rectum, and vaginal prolapse. Such fibromata or sarcomata as are well isolated or pedunculated or have narrow bases, may be removed, most conveniently with the cautery.

Extensive sessile growths, especially when sarcomatous, cannot be satisfactorily dealt with by operation.

Cysts of the vagina.—These tumours are rare, are usually single, and are most often met with in the lower third of the canal. They are small, and seldom exceed the size of a hazel-nut. Their walls are usually thin, and their contents may either be clear and serous, or red, brown, or greenish, and thick and tenacious. Most of them are probably derived from obstructed mucous follicles, while others may be altered hæmatomata. Klebs believes certain of them to be dilated lymph vessels, while Freund states that others may be derived from remnants of Muller's duct. When small, they cause no trouble. When large they may excite a chronic catarrh and produce the symptoms of a foreign body; or they may burst, and lead to an offensive discharge.

Treatment.—Excise a part of the cyst wall with scissors, and freely cauterise all such part of the sac as remains.

Cancer.—Primary cancer of the vagina is very rare, and always takes the form of epithelioma. In most cases the disease is secondary to like mischief in the vulva or uterus.

The vaginal walls become hard and contracted, the surface bleeds and produces an offensive discharge. There is much pain that radiates to the neighbouring parts, and disturbance of the rectum and bladder. Examination reveals the typical epitheliomatous ulcer. If the growth be seen when it is very small and well circumscribed, it may be excised. In the majority of cases palliative measures can be alone entertained. Schrœder has excised nearly the entire vagina for cancer, but the operation cannot be advised.

Fistulæ.—The following fistulæ are to be met with in or about the vagina. They may be arranged in their order of frequency. 1. Between the bladder or urethra and vagina (vesico-vaginal). 2. Between the rectum and vagina (recto-vaginal). 3. Between the bladder and uterus (utero-vesical). 4. Between the rectum and uterus (utero-rectal). The two last-named are very rare, and need not be considered in this place. These fistulæ result usually from sloughing, following protracted and difficult labour. They may result also from laceration, from ulceration produced by an impacted foreign body in the vagina, in rare cases from ulceration caused by vesical calculus, and in the rarest instances by spontaneous ulceration of the vagina.

These fistulæ cause much distress, and can be readily diagnosed by direct examination of the parts, and by the escape of urine or fæces by the vaginal orifice. They vary in size. Some may barely admit a probe, while others may admit a finger. In the severest cases, the bladder and vagina, or the vagina and the rectum, may almost appear to form one cavity. The vesico-vaginal sinus is most usually placed about half-an-inch below the anterior edge of the os uteri. The recto-vaginal fistula is commonly placed low down "at the point," writes Dr Barnes, "where the floor of the perinæum begins to incline forwards from the hollow of the sacrum."

The last-named fistula causes much less distress than the vesico-vaginal form. When small it may heal spontaneously, or may close after the application of the actual cautery. This cannot be said, however, of the sinuses that lead into the bladder.

Operation.—The procedure for closing the fistula is undertaken when the permanency of the sinus is established, and after the cautery, in the case of the smallest openings, has failed. The patient should be in good health, the parts in as healthy a state as possible, and the rectum or bladder thoroughly emptied.

For recto-vaginal fistulæ the patient is placed in lithotomy position, for the vesical form in the semi-prone posture. The sinus is exposed by means of a Sims' duck-bill speculum. The edges are freely and evenly pared by means of a proper knife and forceps, and the raw margins are then adjusted by sutures. Various ingenious needles and needle-holders have been adapted for this purpose. The best materials are silver wire, or silk, or silk-worm gut. The stitches are introduced about one-third of an inch from the edge of the wound, are introduced in the proportion of six to the inch, and, when wire is used, are secured by twisting. If other material is employed, they are fixed by means of the shot clamps. The patient must be kept at rest, the vagina be frequently irrigated with some antiseptic solution, the bowels kept confined (in the case of rectal fistulæ) for about ten days, and the bladder emptied every eight hours for the first three days. The sutures should be removed on the sixth day.

Atresia of the genital passage.—This usually depends upon congenital deformity.

1. The hymen may be imperforate.

2. The vagina may be absent in whole or in part, or it may be closed by a transverse septum. Vaginal atresia may also result from contracting cicatrices following destructive ulceration, injuries, or protracted labour.

3. The external os may be closed, or the atresia may involve the entire cervix. The cervix and upper part of the vagina may be occluded after parturition. Occlusion of the cervix may also result from certain operations upon the part, from the too free use of caustics, and from the growth of cervical neoplasms.

In congenital cases no trouble results in those instances where the uterus and ovaries are absent. When these organs are present, symptoms develop as soon as menstruation is established. The menstrual blood collects behind the obstruction.

In atresia hymenalis, the uterus remains, for a considerable time at least, unaffected, while the vagina becomes distended into an enormous blood cyst (hæmato-kolpos).

In atresia vaginalis the cervix becomes opened up, and the uterus becomes distended (hæmato-metra). The tubes also in time become involved, and are found in the condition known as hæmato-salpinx. Some of the altered blood in the tubes may escape from time to time into the abdomen, and give rise to local peritonitis.

The fluid in the cysts may be like thick blood, or be of a chocolate colour, or be black and semisolid like tar.

In atresia hymenalis the quantity collected behind the obstruction has amounted to from eight to fourteen pounds.

The **diagnosis** is not difficult. There is great and increasing pain and constitutional disturbance at each menstrual period, but no discharge of blood. The periods of pain increase in duration, and in time serious defects in health result. The genital canal is found on examination to be occluded at some spot, and a tumour, due to accumulated blood, can probably be made out, especially on rectal exploration. If the case be untreated, the occluding membrane may burst, and a cure follow. Often, however, this spontaneous relief is followed by a fatal peritonitis, or by septicæmia. The uterus may rupture, most usually about the cervix; but the commonest cause of death is from rupture of the tubes.

Some patients die of exhaustion before such rupture takes place. In others death is hastened by the supervention of nervous symptoms. In rare cases the trouble persists without serious effects until the climacteric, when the symptoms spontaneously abate. In such instances the climacteric may appear very early.

Treatment.—1. In imperforate hymen and vaginal septa the membrane merely requires division. 2. In cases of partial absence of the vagina the tissues between the urethra and rectum may be opened up by dissection; a sound being retained in the urethra, and a plug in the bowel during the procedure. When the os has been reached the passage is kept open by laminaria, and frequent digital exploration. 3. In complete absence of the vagina, and in cervical atresia, the hæmato-metra should be opened by puncture through the rectum.

All these operations (even the simple division of the hymen) are, in cases of long standing, attended by a very high mortality. If the fluid be rapidly evacuated, there is great risk of fatal peritonitis from rupture of the Fallopian tubes. This may be brought about by sudden alteration in the relative amount of pressure exercised upon the parts, by uterine contractions, or by the disturbance of adhesions. If the material be slowly evacuated, the collection is apt to become putrid, endometritis follows, and then death from septicæmia. The best plan, therefore, is to evacuate the cyst slowly, under the most careful and strict antiseptic precautions that can be adapted to these parts.

The Ovary and Broad Ligament.

Tumours of the ovary and broad ligament.—These growths, which must be considered collectively, may be classified as follows :

The ovary.	1. Multilocular cystic tumours. 2. Papillomatous cysts. 3. Dermoid cysts. 4. Solid tumours.
The broad ligament.	5. Simple cysts of the broad ligament. 6. Parovarian cysts.

Of these tumours, the multilocular cyst of the ovary is by far the most common. With regard to the solid tumours of the ovary, the great majority of them are either sarcomata or cancers. Apart from these malignant growths, solid tumours of the ovary are exceedingly rare.

The **relative frequency** of the various tumours of the ovary and broad ligament has been estimated by Mr. Bryant from an analysis of eighty-eight cases. From this analysis it would appear that the multilocular cystic tumours, with which are included the papillomatous cysts, are represented by sixty-four per cent. The cysts of the broad ligament and parovarium form nine per cent. of the whole. The dermoid cysts of the ovary are also represented by nine per cent., and malignant tumours of the ovary by the remaining eighteen per cent.

Pathology.—In the account that follows, extensive use has been made of Mr. Allan Doran's very excellent treatise "On Tumours of the Ovary, Fallopian Tube, and Broad Ligament."

1. **Multilocular cystic tumours.**—These tumours may attain enormous size, are roundish in outline, and are apt to be irregular upon the surface on account of the protrusion of some of the

secondary cysts. They are found to be composed of an aggregation of a large number of cysts (secondary cysts) of all sizes, and arranged without order. Within these cysts is contained a fluid material. It usually happens that one, or perhaps two of the component cysts predominate over all the others, so that at first sight the tumour may appear to be unilocular or bilocular. The smaller cysts, which may vary in size from a pea to a child's head, are arranged about the walls of these predominating cysts. It is the projection of the latter that renders the outline of the tumour irregular. The whole growth is enclosed within a sac of dense, opaque, fibrous tissue, which, however, cannot be separated from the walls of the contained cysts (Fig. 35).

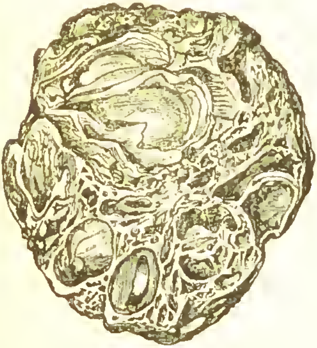

Fig. 35.—Multilocular Cystic Tumour of the Ovary.

The outer surface of this sac is covered with endothelium-like cells, and presents a smooth, glistening, and silvery appearance.

The fluid contained within the tumour may amount to several gallons. It is usually greyish or colourless, glairy, and albuminous. If any hæmorrhage has taken place into the cysts the colour of the fluid will be reddish or reddish-brown. If colloid changes have taken place in the cyst contents, then the fluid will be found to be thick and jelly-like, and of a faint yellow colour.

The walls of the smaller cysts are lined with columnar cells, the larger and tenser cysts with endothelium-like cells. This difference is probably the result of distension merely.

It is evident that the larger cysts are to a great extent due to the fusion of smaller cysts. Growing cysts meet; their walls are pressed against one another; in time these opposed walls atrophy and the two cavities become one. In this way are produced the loculi, the bars, septa, meshes, and ridges, that are found upon the walls of the predominant cysts.

A large secondary cyst may protrude through the main wall and form a considerable projection. Or the main wall may, after rupturing, undergo atrophy, leaving a tumour composed of secondary cysts. This, the so-called exogenous cyst, has been aptly compared to a pile of cannon balls.

Mr. Doran has pointed out, that when cystomata of both ovaries exist, the tumours may meet, may fuse by the bursting of some secondary cysts of the one into those of the other, and so in time form a single tumour with a double pedicle.

About 30 per cent. of these tumours contain solid growths. These growths occupy the secondary cysts, and are usually glandular (adenoma). They appear upon the cyst walls as soft, succulent, and semitransparent masses of a greenish-grey colour. These masses, when examined, are found to be composed of innumerable minute cysts and loculi, lined with columnar epithelium, occupied by a mucoid fluid, and supported by young succulent connective tissue.

The fluid from the secondary cysts that contain these solid growths is marked by being unusually glairy and mixed with semisolid and opaque fragments of tissue. In rare instances, the supporting tissue in the solid growths is sarcomatous (adeno-sarcoma), and, in still rarer cases, the solid growth presents the characters of colloid cancer.

The pedicle with which ovarian cystomata are provided is dealt with below.

The precise mode of origin of these cysts is still open to some little doubt. The most commonly accepted theory is that they are developed from the normal ovarian follicles. It must be remembered that the proper function of the ovary is to develop cysts, and it is not difficult to conceive that a morbid deviation of that function may lead to these multilocular cystomata. There are a vast number of follicles in the ovary that never become concerned in either menstruation or pregnancy. In the ordinary course of events these follicles atrophy. An arrest, or rather a perversion of this atrophic process, may readily lead to the tumours in question. Mr. Doran concludes an able discussion of the subject in these words: "The most probable origin of cystic disease of the ovary is an arrest of the normal retrograde metamorphosis of Graafian follicles that have never become corpora lutea of menstruation or pregnancy." The term "proliferous," that is sometimes applied to these tumours, is open to direct objection. Such a term implies that the smaller cysts developed within the main sac are the progeny of a primary cyst, about and from the walls of which they have sprung. If the theory just expressed be true, then all the cysts, both great and small, that the tumour contains are derived from the same source, ovarian follicles. They differ only in age, in rate of growth, and in the accidents of position. They differ in degree, but not in kind, and are, so far as their immediate origin is concerned, quite independent of one another.

2. **Papillomatous cysts.**—These are multilocular cysts, differing in no way from those just described, save in the important particular that the component cysts contain exuberant papillary growths. These tumours spring from the hilus of the ovary and not from the parenchyma. In the hilus are traces of the Wolffian body, and from these remains the present form of tumour is supposed to be developed. It is affirmed also, that when the common multilocular

tumour presents traces, as it sometimes does, of papillary growths, then the cyst must have spread from the parenchyma to the hilus. Pure growths from the hilus contain only papillary growths. These growths appear as luxuriant cauliflower masses. Their surface is covered with cylindrical epithelium, and they readily bleed if touched. They are apt to spread rapidly. They may burst through the capsule of the main cyst, and, invading the peritoneum, may spread over it and grow and extend with great vigour (Fig. 36). The cysts themselves may attain immense proportions. The fluid within cysts that contain papillary growths is peculiar. It is clear, thin, not glairy, and almost devoid of organic products. Hæmorrhage into cysts of this nature is common.

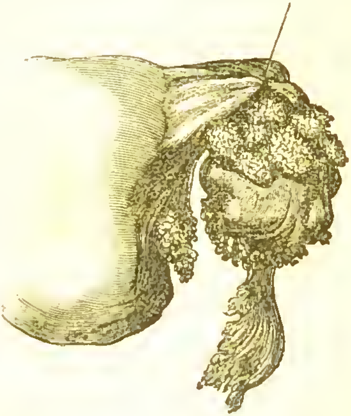

Fig. 36.—An Ovarian Tumour associated with Papillomatous Growths. (After Robert Barnes.)

3. **Dermoid cysts.**—These tumours are precisely similar to the dermoid cysts that are found in other parts of the body. Their precise mode of origin is unknown. Their walls vary in thickness and are lined with dense layers of squamous epithelium. Their contents may be like sebaceous matter, or if this matter be mixed with blood, like a brown or chocolate-coloured paste. In other instances the contents are more fluid, may be glairy, or like oil or glycerine.

In addition, these cysts nearly always contain hair, and often teeth. In other cases they may contain portions of bone and of cartilage. They are commonly multilocular. Unlike the cystomata, already dealt with, the outer wall of the dermoid cyst is not smooth and silvery, but is dull of aspect and of a grey or greenish colour, mottled with deeper tints.

These tumours are usually small; commonly about the size of an orange, and rarely as large as a man's head. They do not fluctuate, but feel hard and irregular. In about one-fourth of the cases both ovaries are involved. These tumours may remain long stationary.

4. **Solid tumours.**—The majority of these are sarcomata and cancers. The usual form of sarcoma met with is of the spindle-celled variety. Rare instances of fibroma and of fibro-myoma have been recorded, and Kimsch has observed two examples of enchondroma of the ovary. These various growths call for no special description, since they do not differ from like neoplasms in other parts.

5. **Simple cysts of the broad ligament.**—Ovarian cysts are multilocular. All cysts of the broad ligament, or of the parovarium, are unilocular. With regard to the former, some appear to be developed from the connective tissue of the ligament, others may be due to an enlargement of the dilated outer end of the horizontal tube of the parovarium, while a third set appear to be developed from the tissue in the vicinity of the ovarian fimbria of the Fallopian tube. All these cysts are quite simple and unilocular. They may attain great size. They appear as rounded tumours of regular outline. Their walls are thin and have a dark aspect, due to the fact that the contained fluid shows through them. In this respect they differ from the ovarian cystomata. The contained fluid is thin and watery.

6. **Parovarian cysts.**—The parovarium, or organ of Rosenmuller, can be seen on holding the broad ligament up to the light. It lies between the ovary and the Fallopian tube and between the layers of the

ligament. It is composed of some fifteen vertical tubes that end above in a horizontal canal. The outer tubes are lined with imperfect cubical epithelium ; the inner tubes are represented by slender and impervious cords. The horizontal tube ends internally in a cord-like band which can be followed as far as the uterus (the obliterated duct of Gartner). Parovarian cysts are developed from such tubes of the organ of Rosenmuller as contain epithelium. They resemble, in their general features, the simple broad ligament cysts, but differ in this, that they contain, often in large amount, papillary growths of the same character as those met with in the hilus cysts of the ovary.

The pedicle of all ovarian cysts, with the exception of such as grow from the hilus, is composed of the Fallopian tube, much elongated, of the thickened broad ligament, of the utero-ovarian and round ligaments, and of many large blood-vessels. The length of the pedicle varies from two inches to several inches, and Sir Spencer Wells records one instance in which it measured over a foot. It may appear in two divisions.

The papillomatous cysts that grow from the hilus tend to be sessile. They grow between the layers of the broad ligament and carry the ovary upon their surface. Even when a pedicle exists in the other ovarian cystomata, the ovary is usually found in very close contact with the tumour, and often flattened out upon its surface.

The broad ligament and parovarian cysts present pedicles containing the same structures as those attaching ovarian tumours, but such pedicles are shorter and broader. If the broad ligament cyst spreads upwards it may present a good pedicle, but the parovarian tumours are often sessile, like those that grow from the ovarian hilus. In any instance, the Fallopian tube, or a large part of it, will be found stretched out over the surface of the cyst, while the ovary may hang free by the side of the tumour.

Twisting of the pedicle.—This is due to the rotation of the tumour, but the causes of that rotation are unknown. The condition can only be met with when the pedicle is of fair length and comparatively narrow. Sir Spencer Wells states that the tumour may be rotated round its axis as many as two or three times. The uterus is pulled in the direction of the rotation. The twisting may be spontaneously reversed, and after such recovery it may again recur. It follows from this twisting that the veins become compressed, while the arteries are not entirely occluded. The result is great congestion of the cyst, with much exudation of serum, and possibly extensive hæmorrhage and subsequent rupture of the sac. In other instances gangrene and sloughing of the tumour, or of parts of it, follow. In a third series of cases the cyst atrophies, and this wasting may in rare instances reduce the tumour to a small and inert mass, and so effect a cure. In a fourth class of case, where extensive adhesions are connected with the cyst, the pedicle may waste and disappear, and the tumour derive its future blood supply entirely through the adhesions.

The symptoms of twisting of the pedicle, as described by Sir Spencer Wells, are as follow: Sudden accession or increase of pain; altered pressure sensations from change in the position of the tumour; alteration in the relative position of the tumour and the adjacent viscera; change in the contour of the abdomen, and, in certain cases, evidences of internal hæmorrhage. In one instance reported by Sir Spencer Wells sudden death followed; in other cases vomiting set in, with some of the phenomena of peritonitis.

Prognosis.—The prognosis attending cancer and sarcoma of the ovaries is identical with that of internal malignant disease in other organs.

Cystic tumours may undergo *spontaneous cure* under the following circumstances: 1. Atrophy depending upon twisting of the pedicle. 2. Rupture of the cyst into the bowel, with evacuation of its contents and subsequent closure. 3. Suppuration of the cyst and discharge of its contents through some opening upon the surface. 4. Some dermoid cysts may remain quiescent for a lifetime. All these modes of cure, however, are exceedingly rare, so rare that they have little or no influence in directing the treatment of the disease. Putting aside these very exceptional accidents, it may be said that ovarian tumours will sooner or later end in death if some active treatment be not adopted.

From Mr. Bryant's analysis of his cases it appears that in 75 per cent. the disease runs its course within two years.

Cause of death.—Mr. Bryant's statistics show that 30 per cent. died from exhaustion, 20 per cent. from peritonitis, 17 per cent. from suppuration of the cyst (many of these cases, however, resulting from tapping, a mode of treatment that at the present time is seldom adopted), 9 per cent. from the two last causes combined, 10 per cent from rupture of the cyst, and 10 per cent. from the cyst ulcerating into some viscus such as the intestine or bladder. Among other causes of death may be mentioned hæmorrhage; and strangulation of the intestine by the pedicle of the tumour.

Rupture of the cyst.—This may occur spontaneously or as the result of accident or injury. The rupture may be sudden and complete, and death follow from hæmorrhage or peritonitis; or the cyst may yield gradually, a slight leakage being produced from time to time, slight discomfort following with a trifling amount of peritonitis.

The cysts of all others that are the most liable to rupture are the dermoid; next in order in their liability to rupture may be placed the cysts that contain papillary growths. When such tumours give way the papillary growth is set free, it spreads with vigour, and is soon found to be disseminated throughout the abdomen. The rupture of a simple broad ligament cyst may cause but little trouble, the fluid that they contain being apparently harmless to the peritoneum.

When the outer wall of a multilocular cystoma gives way, the rupture may be blocked by the protrusion of a secondary cyst.

The rupture is, in any case, most usually into the peritoneal cavity. From a table drawn up by Nepven, it would appear that in about 83 per cent. of the cases the rupture is into the peritoneal cavity, in 7 per cent. into some part of the intestine, in 4 per cent. into the bladder, in 4 per cent. through the anterior abdominal wall, and in about 2 per cent. into the uterus or vagina.

The symptoms and diagnosis of ovarian tumours.—In the account that follows the various tumours mentioned at the commencement of this chapter will be considered collectively under the convenient term "ovarian tumour." The differential diagnosis will be dealt with subsequently.

Ovarian tumours have been met with at all periods of life, in infants as well as in aged subjects. The great majority, however, of the cases are in women whose ages lie between twenty-five and fifty-five. The average age of the patient in 1,000 cases of ovariotomy performed by Sir Spencer Wells was thirty-nine. Ovarian growths appear to be much more common in the married than in the single, and are met with in individuals of all nationalities and in all stations of life. The rate of growth of these tumours is most uncertain, and mere size is no guide to the severity of the symptoms. A small tumour may cause the direst distress, while a cyst that fills that abdomen may produce, for a time at any rate, comparatively slight inconvenience. In its early stages the ovarian tumour usually produces no symptoms. It is most commonly discovered by accident, and the patient's account of its origin is often of little value, and sometimes actually misleading. In some instances there is distinct evidence that the mass has sprung from one or the other side. As the tumour enlarges it begins to press upon adjacent structures. As a rule it presses first upon the bladder or the rectum, producing incontinence of urine or dysuria on the one hand, and constipation on the other. It may bring pressure to bear upon the sacral nerves, and thus be the cause of vague pains about the lower part of the back, the vulva, the perinæum, and the lower extremities. By possible narrowing of the iliac veins it leads to congestion of the vagina and of the external genitals, to œdema of these parts, to œdema of the feet and legs, and, in time, of the anterior abdominal wall.

As it mounts up among the intestines it may irritate the bowels, and so produce colic and diarrhœa, or may press upon the stomach and excite nausea and vomiting. As the abdomen is occupied the respiration becomes more and more entirely thoracic. When the tumour attains great size it may press up the diaphragm, may displace the heart apex, and lead to considerable dyspnœa. In advanced cases much fluid may be found in the pleuræ, the lungs may be œdematous, and portions of their bases may be consolidated. With the larger tumours there is usually some ascites. The urine passed is often small in amount, highly concentrated, and loaded with urates; in other cases it may contain albumen. The more serious renal troubles in ovarian disease are probably due to the effects of pressure on the ureter.

Such pressure leads to dilatation of the pelvis, to congestion of the kidney, and ultimately to an interstitial nephritis. During the progress of the growth menstruation may, in rare instances, be quite normal and regular. It is more commonly irregular, or excessive, or entirely arrested. Before the abdomen has attained great size the patient's health begins to suffer. She is worn by the pain and the increasing burden of the growing mass; she is unable to sleep, finding it, perhaps, difficult to lie, or able to lie only in one position. There is naturally, also, no little mental anxiety. Her appetite fails, her digestion is disturbed, her blood impoverished, and her nervous system shattered by imperfect assimilation. She emaciates, and her face soon shows that peculiar physiognomy which has been described as the facies ovariana. Sir Spencer Wells thus speaks of it: "The emaciation, the prominent or almost uncovered muscles and bones, the expression of anxiety and suffering, the furrowed forehead, the sunken eyes, the open and sharply-defined nostrils, the long, compressed lips, the depressed angles of the mouth, and the deep wrinkles curving round these angles, form together a face which is strikingly characteristic."

In every case a pelvic examination should be conducted. For this purpose the patient is placed upon her back with her shoulders and knees raised so as to relax the abdominal walls. The finger is then introduced into the vagina, while the other hand presses upon the belly just above the pubes. By this means the outline and consistence of the tumour can often be made out, as well as its general relations to the contents of the pelvis. The tumour as a rule lies behind the uterus. This organ will be displaced, will be thrust to one side, or retroverted or anteverted. In some cases it may be so dragged up by the tumour as to be beyond the reach of the finger. Generally speaking, the tumour will be found to be round, and, if small, movable. If on vaginal examination the pelvis be found to be clear, it may be taken to indicate a long pedicle. The mass will be found to be free of the uterus, but a sound should not be introduced until the surgeon is satisfied that there is no suspicion of pregnancy. The physical characters of these tumours can be best dealt with in considering the differential diagnosis.

Differential diagnosis.—*Multilocular and unilocular cysts.* This differentiation really resolves itself into the separating of ovarian cystomata from those of the broad ligament or parovarium.

The unilocular, broad ligament, or parovarian cyst.—The tumour is rounded, smooth, and of regular surface. These features are made manifest both by the abdominal and vaginal examinations. It feels elastic, and presents a sense of fluctuation that is equally felt in all parts. Again, if the fingers of one hand be placed flat upon the swelling, and maintained steadily against it, while a distant part of the tumour is sharply tapped by the fingers of the other hand, a thrill will be felt to pass through the mass. This fluctuation wave will be made out in all diameters of the tumour, and is most distinct when the walls of the belly and the cyst are both thin, and the latter fully distended. The mass will of course be dull on percussion. The margin of the dulness will be precise, and will be surrounded by a resonant area (intestinal). These tumours are much more likely to be freely movable than are multilocular cysts of equal size. They may have lasted for years with little damage to the health, and, other things being equal, cause much less distress than the multilocular cysts. They are, moreover, less likely to contract adhesions.

The multilocular cyst is more substantial. Although in general outline round, its surface is usually irregular, and sometimes very irregular. Fluctuation is not so well marked as in the previous form of growth. When present it will be less distinctly felt in some places than in others. If the contents are very colloid, the component cysts small, and the parietes thick, it may be impossible to detect any fluctuation, and in its physical characters such a tumour could not be distinguished from a sarcoma. The thrill of the fluctuation wave on percussion will be absent. In some cases, however, a secondary cyst attains such size, that it forms the greater part of the tumour, and, in such an instance, the part of the tumour occupied by the secondary cyst will present the features of the unilocular cyst. As already stated, these growths cause more distress, and are more likely to contract adhesions than are the simple tumours.

The dermoid cyst will be small, will most probably be met with in a young subject, will be dull on percussion, of irregular outline, and quite hard to the touch. Such cysts may present nodular projections that feel as hard as cartilage. Some of them may feel elastic, but they do not fluctuate.

Errors in diagnosis.—There are few abdominal swellings, and certainly none taking origin from the pelvis, that have not, at one time or another, been suspected of being ovarian. The following are the conditions that may most readily lead to error.

1. **Ascites.**—(*a*) *Form of abdomen.* In ascites the sides of the abdomen protrude more than the front. In ovarian disease this condition is reversed. Alteration in the posture of the body produces greater and more immediate changes in the form of the belly in ascites than it does in ovarian disease. In ascites, the greatest circumference of the abdomen will be about the umbilicus, whereas in ovarian cystomata it will usually be some inches lower down.

(*b*) *Dulness and fluctuation.*—It is assumed that the examination is conducted while the patient lies flat upon her back. In ovarian tumour the area of dulness is in the front of the abdomen; its limits are sharply marked, and it is surrounded by an area of resonance (intestinal) (Fig. 37). Even when the cyst is of large size, resonance can usually be detected in one or both flanks. In ascites, the abdomen is resonant in front, but dull at the flanks, owing to the gravitation of the fluid thither (Fig. 38). Its limits, moreover, are not well marked. In ascites, the dulness varies with change of posture, *e.g.* if the patient turn over to one side, then the other side that was before dull will be found to be resonant. In the cystomata change of posture does not effect the dulness.

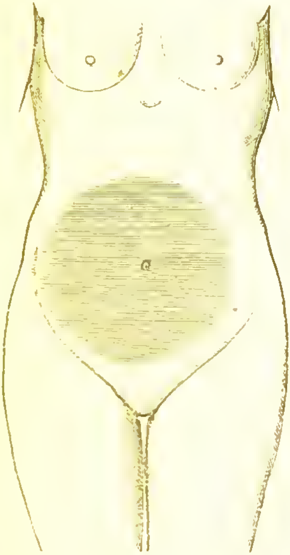

Fig. 37.—Area of Dulness in Ovarian Tumour.

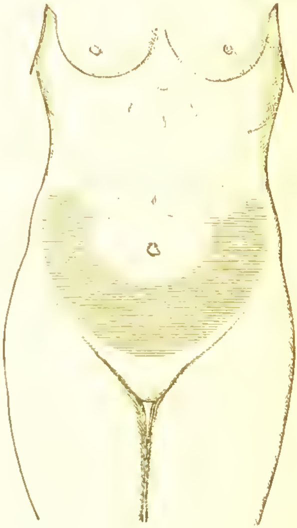

Fig. 38.—Area of Dulness in Ascites.

"In ascites, at any spot near the level where the resonance of the intestines ends, and the dulness of the fluid begins, and a dull sound is elicited by *gentle* pressure and percussion, a *deeper* pressure will displace the fluid, and the resonance of the intestines will be heard. Superficial and deep percussion cannot produce such difference in the sounds in ovarian disease.

"When fluid is free in the peritoneal cavity, the wave of fluctuation may be felt not only where the sound is dull on percussion, but also beyond the line of dulness, even where resonance may be tympanitic. The intestines float in the fluid, and the fluid may be thrown in waves among them. But when fluid is contained within a cyst, fluctuation cannot be detected beyond the boundaries of the cyst. Hence the outline of the cyst, traceable by dulness on percussion, and the line where fluctuation can be perceived, must be the same."

(*c*) *Character of fluid.*—This may sometimes be ascertained by exploratory aspiration. The thin serous fluid of ascites is readily distinguished from the thick glairy fluid of the most common form of ovarian growth. It may, however, not be distinguishable from the thin and limpid fluid that escapes from unilocular cysts. Numerous tests have been devised to separate such fluid from that met with in ascites, but without very satisfactory results. The two tests upon which some still place reliance are the following: (1) Boil the fluid. A coagulum forms. If this dissolves in boiling acetic acid, the fluid is ovarian; if it will not dissolve, it is ascitic. (2) Allow some of the fluid to stand for twenty-four hours. If at the end of that time a slight coagulum of fibrine filaments is to be noticed, the fluid is ascitic, for there is no spontaneously coagulating fibrin in ovarian fluid.

(*d*) *Other points.*—The history of the case will be of great importance, and also evidence of the presence of such diseases as produce ascites.

The diagnosis is complicated when air or gas is found within an ovarian cyst (since it will produce a resonant note in the middle line), when ascites coexists with ovarian disease, and when a simple dropsy is so considerable that the anterior wall of the abdomen is pushed beyond the reach of the intestines, and the dull note of the fluid is to be heard all over the front of the belly.

2. **Encysted dropsy of the peritoneum.**—This condition results from chronic peritonitis. Some of the fluid effused is enclosed in a cyst-like cavity formed by adhesions that connect adjacent viscera. The amount so encysted is usually small, although it may amount to several quarts. This encysted dropsy is most common in cancerous and tubercular peritonitis, and therefore the history and general health of the patient are matters of primary import in the diagnosis. These collections have less defined boundaries than ovarian cysts; fluctuation is less distinct, the abdomen is flatter, the collection is not movable; often the collection is so shallow, that on deep percussion the resonance of the bowels beneath the fluid can be brought out.

3. **Hysterical tympanitis.**—Here the abdomen is uniformly distended; is round, hard, and resistant; is everywhere tympanitic; the patient is the subject of hysteria, and under chloroform the whole tumour disappears.

4. **Pregnancy.**—*a.* The age of the patient may at once settle the question of pregnancy. *b.* There may be such disease or deformity of genitals as to render conception impossible. *c.* The pregnant uterus forms a tumour that commences in the median line. *d.* A tumour, known to have been present for nine

months and yet no larger that a uterus at the fourth month, cannot be due to pregnancy. *e.* The ovarian tumour causes more distress. *f.* There are the familiar signs of pregnancy. To these, however, too much attention must not be given, since they may be imitated in ovarian disease. *g.* The fœtal heart sounds can be heard, and the fœtal movement felt, after the sixth month. *h.* It can be established by pelvic examination that the tumour and the uterus are one.

5. **Extra-uterine pregnancy.**—The chief points are the age of the patient, the history of conception, the signs of pregnancy, the fœtal heart and fœtal movements, the signs of spurious labour at the end of nine months with subsequent diminution in the size of the cyst.

Errors in diagnosis have also depended upon fatty tumours of omentum; tumours of the peritoneum or subserous tissue; hydatids; distended bladder; fæcal accumulations; diseases of the uterus, especially such as are attended with distension of its cavity; renal cysts; pelvic abscess; hæmatocele.

Recognition of adhesions. — Adhesions between the cyst and adjacent parts are frequent, are invariably the result of some local peritonitis, and may seriously complicate an operation. They may connect the cyst with the parietes, the intestines, the omentum, the bladder, uterus, and rectum, and in rare cases with the liver, or stomach, or spleen. The relative frequency of such adhesions is shown by the following table drawn up by Sir Spencer Wells: In 500 cases. No adhesions in 212 of the cases. Parietal adhesions in 61. Parietal and omental in 63, omental only in 62. Intestinal adhesions, pelvic and others, in 102. The most serious adhesions are those about the pelvis that connect the cyst to the bladder or rectum, or the appendix vermiformis, or to coils of ileum lying in the pelvis, or to the iliac vessels. According to Sir Spencer Wells, instances where the tumour is so fixed by adhesions that it has practically to be enucleated, may be expected in five cases out of every hundred. Adhesions are difficult to recognise before operation. They may be absent in cases where severe symptoms of peritonitis have existed, and present when no such symptoms have been noted. Mr. Doran states, that out of 500 cases of ovariotomy he has witnessed, were forty-five examples of multiple adhesions without any previous history of peritonitis.

To detect adhesions.—Place the patient on her back with the belly a little relaxed. If the cyst be free it will move up and down with the respirations, descending one or two inches with each inspiration. If close adhesions exist there is no such movement, but the cyst and the abdominal wall move together. If, however, the adhesions be very long the cyst may still move; but in such a case, if the hand be placed flat upon the abdomen, a grating or creaking (due to the friction of long adhesions) will be felt, and also a friction sound heard. These signs may be to some extent imitated by omentum lying in front of the sac and by the rubbing of surfaces covered by recent lymph. So long as the signs are present the cyst must be movable. They cease where the cyst is quite fixed. "The umbilicus is not affected by the movements of a free cyst during respiration, or when pushed in various directions. But any movement communicated to a cyst which adheres to the front of the abdominal wall is immediately followed by a corresponding movement of the navel" (Wells). In the next place the patient may be placed upon her knees, with her chin resting upon the bed. If extensive pelvic adhesions exist, the finger in the vagina or rectum will recognise that in this posture the cyst does not move towards the thorax.

Treatment.—1. *General.* In any instance a patient suffering from ovarian disease should be placed under the most favourable hygienic conditions. The diet should be simple and nutritious, and the usual measures should be adopted to correct any digestive disturbances when such exist. If constipation is present the bowels must be kept open by the use of enemata and gentle aperients. Pain may be relieved by morphia in the form of hypodermic injection or suppository. Mere restlessness and inability to sleep, independently of any pain, may be met by bromide of potash. The abdomen, if of large size, should be supported by a suitable belt or binder, and the posture of the patient should be consulted, so as to relieve as far as possible the symptoms due to pressure. It will sometimes be found that the patient is passing only a small quantity of highly concentrated urine, that deposits mixed urates in abundance. "If ovariotomy be performed on a patient in this condition," writes Sir Spencer Wells, "a serious amount of kidney congestion, with symptoms almost amounting to uræmic fever is almost certain to follow the operation." The state of the urine may be improved by the use of warm baths, by promoting a free action of the skin and of the bowels, and by the administration of the alkaline carbonates with lithia. The patient's condition may be improved by tonics, and especially by the administration of iron. It is needless to say that no drug and no course of medicinal treatment will have effect upon any ovarian tumour.

2. *Operative.*—There is only one certain means of relieving a patient of an ovarian tumour, and that is by the operation of ovariotomy. Before ovariotomy became an established procedure, various surgical measures were in vogue. Cysts were tapped and injected with iodine, or were kept of small size by many repeated tappings. They were evacuated, also,

through openings made in the vagina or rectum, or they were cut into and drained. These various measures were attended by a fearful mortality, and do not call for serious comment at the present day. They have become merely matters of history. One procedure, however, demands some notice, and that is the process of simple tapping.

Tapping through the abdominal parietes.—There are cases where a patient and her friends will not consent to a cutting operation, and there are other cases where, for various reasons, medical and otherwise, the question of ovariotomy has to be for a time postponed. In such instances the point may be raised as to the value of a simple tapping through the anterior abdominal wall. Such tapping, it must be confessed, is very seldom justifiable. Not only is it dangerous in itself, but it is, in the vast majority of cases, only of temporary utility, and is apt to be followed by adhesions, whereby the success of a subsequent ovariotomy may be seriously involved. There is, however, one form of cyst, and probably one only, in which a single tapping may be followed by a complete cure. This is the simple unilocular cyst of the broad ligament. Nevertheless, most surgeons at the present day would prefer to treat such a cyst by ovariotomy rather than by tapping. The reasons for this preference are these: 1. The tapping may not be successful. 2. If unsuccessful it may lead to the formation of serious adhesions. 3. It is not possible to distinguish the simple cyst of the broad ligament from the unilocular parovarian cyst. Now this latter cystoma contains papillary growths, and the tapping of its sac would probably encourage the increase of these growths and their invasion of the peritoneum. This is perhaps the most serious objection that can be urged against the tapping of cysts supposed to be simple broad ligament tumours. 4. Ovariotomy is, as a rule, peculiarly simple when these unilocular cystomata are concerned.

With regard to multilocular and dermoid cysts, it will be seen that, not only can they not be cured by the process of tapping alone, but they cannot even be evacuated by a trocar.

Sir Spencer Wells' conclusions with regard to tapping in these multilocular cysts are as follows: "It may sometimes be a useful prelude to ovariotomy, either as a means of gaining time for a patient's general health to recover, of clearing the urine of the albumen with which it is sometimes charged under the mere influence of pressure, or of lessening shock by relieving her of the fluid a few hours or days before removing the solid portion of an ovarian cyst."

If a cyst is to be tapped the patient should lie upon her side, at the edge of a bed, with the abdomen projecting a little beyond the edge. An incision large enough to take the trocar is made with a scalpel in the linea alba, below the umbilicus. The best trocar for the present purpose is that invented by Sir Spencer Wells, since it prevents the admission of air into the cyst. After the cyst has been slowly evacuated, a pad of lint secured by strapping is placed over the skin wound.

Ovariotomy.—When the diagnosis of an ovarian tumour has been clearly established the sooner the growth is removed the better. No substantial reasons can be urged in favour of delay; even small tumours, such as dermoid cysts, that have remained quiescent for years may at any time enlarge and, after no prolonged period of growth, rupture. The mortality after the operation is now so low that the patient will run greater risks by retaining an apparently quiescent tumour than by subjecting to its removal by the knife.

It is important that the patient should at the time of the operation be in a fairly good state of health. The general health has, perhaps, more to do with the success of the operation than the condition of the cyst. The size of the growth, regarded as an isolated factor, has practically no influence upon the result of the treatment. It is obvious, however, that large tumours mean longer duration and a more prolonged period of distress, and of drain upon the system.

Contra-indications.—The operation should not be performed if the patient's health be exceedingly poor, and there is great prostration. In this matter the general surgical principles that would forbid any great operation will equally forbid an ovariotomy. The operation should not be performed if any independent organic disease exists, which, apart from the local malady, would lead to a comparatively early death. Thus it would not be justifiable in patients exhausted by diabetes, or in advanced stages of phthisis, or of Bright's disease. In such individuals a threatened rupture of the cyst may be averted by tapping, and life be thus prolonged with some increased degree of comfort. In cases of malignant disease an operation would only be justifiable while the growth remained limited to the single organ. Ovariotomy would be worse than useless if the disease had spread to adjacent parts, and had led to the cachectic state of advanced cancer. The careful selection of cases for operation, upon sound surgical grounds, has had much to do with the present success of ovariotomy.

The part played by adhesions.—Adhesions, especially when extensive and matured, and attached to adjacent viscera, add in a very special manner to the gravity of the operation. The following table, showing the results of the operation in Sir Spencer Wells' second series of five hundred cases, will express the degree of danger that attend this complication :

Adhesions.	Cases.	Mortality.
None	212	13·67
Parietal	61	18
Parietal and omental .	63	19
Omental	62	24·19
Intestinal, pelvic, and others	102	37·25

The operation.—The ovariotomy should be performed in a small, well-lighted, and well-ventilated room, which should be maintained at a temperature of about 65° during the operation. The less furniture the room contains the better, and all carpets and curtains should be removed. As the operation should be conducted with the strictest Listerian precautions, it is as well that a carbolic spray be set going in the room for some two or three hours before the operation, and before the patient is admitted. No food should be taken for three or four hours before the operation ; the bowels should be well cleared out by enema, and the bladder emptied by the catheter just before the patient is placed upon the table. Her lower limbs should be enveloped in warm woollen stockings, and the upper part of her body in a thick flannel jacket. It must be borne in mind that without such protection the body may be much chilled by the spray, the temperature of which will be some degrees below that of the surrounding air. The pubic hair should be shaved off, and the front of the abdomen well washed with soap and water, and then with a carbolic solution. A large waterproof sheet is now to be applied. This is provided with an oval hole, measuring eight inches by six inches ; around the margin of the opening a strip of adhesive plaister one inch in width is sewn. When everything is ready the strapping is warmed, and the sheet applied so that through the opening is exposed the front of the abdomen, the lower extremity of the opening corresponding to the symphysis. The lower limbs should be enveloped in a blanket, and then wrapped round in a mackintosh sheet; in fact, the whole body, with the exception of the face and front of the belly, should be protected by a waterproof covering. The spray should be employed during the whole of the procedure, and the usual details of Listerism carried out. In connection with the question of antiseptic measures in ovariotomy, it is only fair to say that certain eminent surgeons, notably Mr. Bryant and Dr. Keith, do not adopt the Listerian method, and yet obtain most successful results.

Ether is the best anæsthetic under most circumstances. Sir Spencer Wells always uses and strongly advocates bichloride of methylene.

The incision is made between the umbilicus and the pubes, should be precisely in the median line, and large enough to at once admit the hand. There is practically no linea alba below the umbilicus, and thus it happens that the sheath of one rectus is often opened. The tissues should be divided with the knife alone, and should not be disturbed and mutilated with a director; any bleeding that occurs may be checked by Wells' clamp forceps. When the peritoneum is exposed it should be pinched up between the finger and the thumb to ensure that it is free. This having been made clear, a minute fold is to be picked up with the forceps and divided, the cavity being thus opened. If the incision requires enlarging it should be enlarged upwards; the first two fingers of the left hand are introduced into the belly, and play the part of a director, while the cut is made with a straight blunt-pointed bistoury. When the cyst has been exposed the hand is at once introduced into the belly, and passed all round the tumour to ascertain that it is free from all adhesions. If adhesions exist between the cyst and the belly wall the incision had better be continued up until the adhesion area is cleared. If, however, it is impossible to clear the area by a moderate incision, the cyst had better be tapped at once, and as the collapsed sac is being withdrawn the limit and extent of the adhesions will become more apparent.

In an uncomplicated case the cyst on being exposed is at once tapped with a Wells' trocar. If multilocular the chief sacs can be tapped, one after the other, without withdrawing the trocar.

The collapsed cyst is then drawn through the incision. If the tumour be of large size by reason of much solid growth in its walls, the incision may require to be much enlarged. No special risk attends a large incision, but great risks attend the forcible dragging forth of a cyst through a small opening.

Any protrusion of intestines is prevented by an assistant, by means of a large flat sponge, wrung out in a warm carbolic solution.

The pedicle having been exposed, it is transfixed by a stout needle in a handle carrying (through an eye near its point) some strong whipcord, or thick "Chinese twist." The pedicle so transfixed is then ligatured in two parts. The ligatures should be tied as tightly as possible, and the pedicle then divided immediately beyond them. The ligatures are cut short, and the stump dropped into the pelvis. The other ovary should be carefully examined for disease before the wound is closed. The pedicle having been secured, the pelvis requires to be *thoroughly* wiped out with warm carbolised sponges. I am in the habit, as soon as the abdomen is opened, of introducing one large warmed sponge at once deep into the pelvis, and leaving it there until the time for cleansing the peritoneum has arrived. It may be pointed o that, from carelessness, sponges and even forceps have been left in the patient's abdomen.

The wound is now to be closed. A flat sponge may be placed just within the incision while the sutures are being introduced, and removed before they are drawn tight. Chinese twist is the best material for the sutures. Two straight needles are used, and into them a long piece of "twist" is threaded at either end. By using two needles, all the sutures can be introduced from within out, the serous membrane being pierced first and the skin last. In this way deep sutures, all taking in the peritoneum, should be applied at intervals of one inch. The intervening parts are closed by superficial sutures, most conveniently introduced by Hagedorn's needle and needle holder. No drainage tube is required.

Complications of the operation.—Slight adhesions may be broken down with the finger, or torn across. Larger and more substantial bands must be divided between ligatures. In separating the tumour from adhesions, the latter may be temporarily secured by Wells' larger clamps, divided, and then dealt with after the removal of the cyst. If a surface, from which adhesions have been stripped, continues to ooze, it may be necessary to check the bleeding with the actual cautery. In dealing with deep pelvic adhesions, care should be taken to ascertain the position of the ureter, which may easily be divided or ligatured by mistake.

If the bladder should be accidentally wounded the wound should be closed by the Czerny-Lembert suture, so as to bring the serous surfaces together, and a catheter tied in. Wounds of the rectum or intestine should be at once closed by the same form of suture. If the adhesions are so extensive that removal is practically impossible, it may be necessary either to abandon the operation or remove as much of the growth as possible, and then to close the wound, after having inserted a large drainage tube.

If the cyst has suppurated, it should be removed when possible. If impossible, the cyst should be opened, the edges of the opening secured to the margins of the abdominal wound, and the cyst cavity freely drained.

The removal of both ovaries at one operation adds distinctly to the risks of the procedure. Sir Spencer Wells' statistics show that the mortality of double ovariotomies is 12 per cent. higher than that attending the ordinary operation.

In many instances two successive ovariotomies, undertaken at varying intervals, have been performed upon the same patient. The mortality in these cases has not been above that attending single ovariotomies.

Pregnancy is in itself no bar to the performance of ovariotomy. Patients with ovarian tumours have passed through the period of pregnancy without trouble, and have been delivered safely at the full term. In the majority of instances, however, these patients abort. In any case, if the tumour be increasing rapidly, it is better to perform the operation at as early a period in the pregnancy as possible. Sir Spencer Wells details thirteen cases of ovariotomy during pregnancy. Of this number one only died.

Mortality.—The mortality attending Sir Spencer Wells' first 100 cases of ovariotomy was 34 per cent.; that with his last 100 cases was 11 per cent. "We may now," writes this surgeon, "confidently calculate upon an average death-rate of not more than three or four per cent."

After-treatment.—The patient must be kept in every sense at rest. If she vomits after the operation the nurse should press her hand over the site of the wound during the act of retching. The patient must on no account move from the recumbent posture. For the first three days her water should be drawn off by a catheter every six hours. Pain may be met by morphia. The bowels may be left to act spontaneously, but if no motion has been passed by the seventh day, an enema may be administered. For the first forty-eight hours, at least, and if necessary for the first three days, no food must be given by the mouth. Thirst may be quenched by a little iced water, or by warm milk and water, or a small quantity of hot tea. Hot fluids are usually better borne than iced water. After the first twenty-four hours, two ounces of peptonised beef tea may be introduced into the rectum every three hours, and continued until food can be taken by the mouth. The food first administered should consist of a little milk and beef tea, followed in a few days by arrowroot, or bread and milk. Stimulants should not be given unless demanded by the state of the pulse. The stitches may be removed on the third day, and the antiseptic dressing may be in most cases discarded entirely on the sixth or seventh day. The wound should then be supported with strips of strapping, and dressed with iodoform.

Oophorectomy; Battey's operation; spaying; castration of women.—By this operation is implied the removal of ovaries that are either apparently normal, or that present other structural changes than those of a new growth. Dr. Battey defines the operation as follows: "By the extirpation of an offending organ, endowed with a peculiar and essential function, the performance of which function has become morbid and destructive of health, or endangering life, we seek to abrogate the function itself, and thus do away with its pernicious consequences." Elsewhere he speaks of it as "an ovariotomy to determine the 'change of life' for any grave disease which is incurable without it, and which is curable with it."

It may at once be said that in the great majority of the operations already performed, the ovaries have presented some evidences of structural disease. In the complete operation both ovaries are removed.

Indications.—The indications for this operation have not yet been very distinctly formulated, and considerable difference of opinion exists as to the propriety of performing oophorectomy for certain of the conditions for which it has been already adopted.

Keeping as far as possible to structural changes in the list given, oophorectomy has been undertaken for the following conditions: 1. Persisting hyperæmia of the ovary. 2. Ovaritis. 3. Amenorrhœa, attended with hystero-epilepsy. 4. Occlusion, or absence of uterus or vagina, with violent molimen. 5. Certain cases of uterine tumour. 6. Neuralgia of the ovary, and some cases of mania, epilepsy, and hysteria.

1. The symptoms said to attend this condition are the following: The patient becomes the subject of profuse menstruation, associated with intense pain. Exhaustion, anæmia, and wasting follow. The periods become prolonged, the amount of blood lost is considerable, and the pain may amount to agony. Nervous symptoms, excitement, hysteria, sleeplessness, are apt to supervene. The uterus is often displaced, and the ovaries can usually be felt as large and exceedingly tender bodies. After all other methods of treatment have failed Battey's operation has led to excellent results in these cases. The ovaries on removal have been found intensely engorged, possibly the seat of extravasations, and in a condition probably leading to chronic inflammation.

2. Ovaritis may be acute or chronic. The acute form may be due to injury, to cold, to sepsis after labour, and to extension of inflammation from the uterus or vagina. Its most frequent cause probably is gonorrhœa. There are fever, intense pelvic pain

and great tenderness in the region of one or other ovary. As Dr. Barnes, however, has pointed out, pain in the region of the ovary, even if increased by pressure, is not sufficient evidence of ovaritis. Such pain frequently attends inflammation of the cervix. The patient complains of pain on micturition and defæcation, and coitus is impossible. By removing the cause of the trouble as far as possible, by ensuring complete rest, by employing blisters or fomentations, and using narcotics and sedatives, the mischief may soon subside. It may, however, pass on to abscess or to chronic ovaritis.

In chronic ovaritis the ovary remains tender, painful, and swollen; micturition and defæcation are painful, and coitus impossible. There is at first probably severe menorrhagia, followed by dysmenorrhœa. The patient becomes a confirmed invalid, is the victim of nervous phenomena of various kinds, is wasted and anæmic. In such a case, if all other means of treatment have failed, and if it would appear that the symptoms are not exaggerated or distorted by the nervous condition, there is no doubt that oophorectomy offers a prospect of a complete cure.

3. This condition would appear to be at least the occasional result of advanced chronic ovaritis, wherein the ovary has passed into a state of cirrhosis. Amenorrhœa results, and has been attended in certain cases, with hystero-epilepsy. The ovary on removal has been found hard, enlarged, nodular, and converted for the most part into connective tissue. In instances of this kind a fair success appears to have attended oophorectomy.

4. In these cases the operation would appear to be very clearly indicated, all the patient's troubles depending upon a persistence of the ovarian function.

5. Oophorectomy has been performed in cases of uterine myoma, or fibroma, with the object of lessening

their hæmorrhagic tendencies, and so encourage the atrophy of the growths. It is indicated in cases where the bleeding from the tumours is profuse and persisting, where the danger is constantly increasing, and the patient's life is threatened, and where all means of relief have failed, and no resource remains other than the very grave operation of amputation of the tumour or of the uterus. When the removal of the tumour would be very difficult or dangerous, then very strong claims can be advanced in favour of spaying, since the success of the operation in these cases has been most satisfactory. In these instances the ovaries removed may be quite normal.

6. It is for the conditions named under this heading that the application of the operation is exceedingly questionable. Indeed, so far as practice has at present proceeded in this direction, it would appear to be unjustifiable to remove the ovaries in these cases, unless there is evidence that they are diseased, are beyond the reach of other treatment, and are the principal cause of the nervous or mental disorder. Of late years so great advances have been made by Dr. Weir Mitchell and others in the treatment of hysteria, that for the relief of that condition at least oophorectomy would appear to have small claims. Some of the hysterical patients that have been operated upon have recovered; some have not been improved; while others have become the subject of melancholia or dementia. In actual insanity, also, the indications for this operation are by no means clear, and the same applies to epilepsy, and even to that form in which the attacks are coincident with the menstrual period.

It only remains to be said that in some instances the operation has been performed for "menorrhagia" and "dysmenorrhœa," and the ovaries after removal have not presented any very distinct evidences of structural change.

The operation differs in no essential detail from ovariotomy. The incision is made in the linea alba, below the umbilicus, and must be large enough to admit two fingers. One ovary after the other is drawn out of the wound. The broad ligament is transfixed, and, with the structures it contains, is ligatured in two parts, a third ligature being placed behind the other two. The knots are cut short and the stump dropped into the pelvis. When adhesions exist the incision must be of greater extent, so as to expose the ovary *in situ*.

The mortality after the operation, as estimated from 218 cases collected by Dr. Battey, is 18 per cent. Of those who recovered from the operation, 72 per cent. are reported "cured," 19 per cent. "benefited," and 9 per cent "not relieved."

Prolapse of the ovary.—The ovaries may generally be felt in their normal position on either side of the uterus, and a little below the pelvic brim between the finger pressed upwards in the vagina and the hand pressed downwards from the abdominal wall. The patient, during the examination, should be on her back, with the belly relaxed, the bladder and rectum having been previously emptied. A healthy ovary is generally insensible to moderate pressure.

By prolapse is understood a dislocation of the ovary into the retro-uterine pouch. This may be congenital, or be due to accident, to adhesions, to the pressure of a tumour, to displacement of the uterus, to changes in the bulk of the ovary itself, and also may attend imperfect involution after labour. The left ovary is more often displaced than the right. The prolapsed ovary may give no trouble. It may, on the other hand, give rise to very distressing symptoms. The patient may complain of a sickening pain about the sacrum, of discomfort on defæcation, and of menorrhagia or dysmenorrhœa. The ovary may be felt, may be found enlarged, may be adherent or non-adherent, and pressure on it may be attended by dull sickening pain. It must be borne in mind that a small fæcal mass, a pelvic gland, a distended Fallopian tube, or a pedunculated outgrowth from the uterus, may be mistaken for the ovary. If the body be movable it may be retained in place by a suitable pessary, and much may be done by enforced rest, aperients, sedatives, and in some cases by the use of ergot. If all measures fail, and especially if the ovary be adherent, the case enters the category of those that may be relieved by oophorectomy.

Ovarian hernia.—The ovary may occupy a hernial sac, and has been found in inguinal, femoral, ventral, and vaginal ruptures. It is most often met with in connection with oblique inguinal herniæ of congenital origin. In certain instances it has become strangulated. When gut or omentum occupy the sac together with the ovary, the diagnosis of the condition may be impossible; but when the ovary alone is herniated, a firm ovoid tumour is detected, which becomes swollen and painful on menstruation, and is attended by a sickening pain when squeezed. The condition may be associated with some displacement of the uterus, and with menstrual irregularity. The tumour may be reducible or non-reducible. If reducible the ovary should be replaced and retained by a suitable truss. If irreducible, and the cause of any distress, the sac should be opened and the little body excised. This procedure has been adopted in several instances with perfect success.

THE FALLOPIAN TUBE.

Distension of the tube.—Under this heading three conditions may be named. (1) *Hydro-salpinx*, or dropsy of the closed tube. (2) *Pyo-salpinx*, or distension of the closed tube with pus. (3) *Hæmato-salpinx*, or distension of the closed tube with blood. Of these, the first named is the most common, the last named the most rare.

Hydro-salpinx and *pyo-salpinx* are results of inflammation of the tube (salpingitis). Salpingitis is usually due to the spreading of inflammation from the uterus and vagina. It is most often met with after gonorrhœa, metritis, or labour, or in connection with pelvic peritonitis. By the inflammatory action the orifices of the tube are closed, and the products of inflammation collect therein, and produce distension. In hydro-salpinx are found the modified products of catarrh, a fluid that may be serous or mucoid, or quite watery or semipurulent. In pyo-salpinx the contents are entirely purulent. The inflammation has run on to suppuration, or an extravasation of blood has broken down, and has excited a suppurative change. Pyo-salpinx is very apt to lead to peritonitis, either by extension of the inflammation, or by oozing of pus from the end of the tube, or by the rupture of the tube. The cyst formed in hydro-salpinx may also rupture, and it would appear that in some cases the accident may be attended by no ill results.

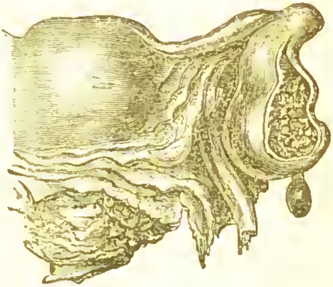
Fig. 39.—Hydro-salpinx. (After Hooper.)

In hæmato-salpinx the closed tube has become distended with blood derived from its mucous membrane. This may be menstrual blood unable to escape owing to atresia in some part of the uterus or vagina; it may also be the result of the hæmorrhage in abortion, or may possibly follow injury. The blood may be absorbed, or may excite suppuration, or may become changed into an inert mass. The blood may escape from the end of the tube, and lead to a retro-uterine hæmatocele.

Diagnosis.—It is practically impossible to distinguish for certain between these various forms of distension of the tube. Most reliance would have to be placed upon the history of the case. In pyo-salpinx there would probably be rigors and increased pain and fever. The remarks that follow, both as regards diagnosis and treatment, will refer to hydro- and pyo-salpinx. The physical characters of the tumour in hæmato-salpinx are of the same nature; but this condition is rare, is seldom attended by marked symptoms, and is, as a rule, secondary to other and more important morbid changes. A simple hæmato-salpinx, moreover, does not demand active treatment.

In hydro- and pyo-salpinx there is usually a history of long standing periuterine or pelvic trouble; menstruation is irregular, is usually profuse, and attended with intense distress. There is much pelvic pain, which is increased by exertion and by straining, and which renders coitus impossible. The distended tubes form cylindrical sausage-like tumours, that are as a rule about the size of a goose's egg, that are tortuous and often bent upon themselves (Fig. 39). The amount of fluid they contain seldom exceeds a few ounces, but may amount to a pint. The tumour may be felt behind Poupart's ligament, and through the vaginal roof, and may present a sense of fluctuation. Most commonly both tubes are involved. The tumour may be movable, or may be fixed by adhesions, and will, as a rule, be found to be very tender to the touch. It will be felt on one side of the cervix uteri, will not have the spherical outline of an ovarian cyst, and will occupy a more forward position than is usually taken by those cysts.

Treatment.—If the diagnosis of hydro- or pyosalpinx has been clearly made, and if the condition causes great and increasing distress, the best treatment consists in the removal of the distended tubes together with the ovaries. The details of the operation are practically identical with those of oophorectomy. The procedure, however, is difficult, owing to the frequency of adhesions, which bind the parts down and obliterate their anatomical details. The treatment of tapping the cyst by the vagina is a little uncertain, is not free from danger, and has not led to satisfactory results.

EXTRA-UTERINE GESTATION.

Extra-uterine gestation.—This term is applied to the development of the fœtus elsewhere than within the cavity of the uterus. The condition may be met with under four forms: 1. Tubal. 2. Tubo-ovarian. 3. Abdominal. 4. Interstitial.

1. The ovum is caught in the Fallopian tube and develops there. The left tube is more often the seat of gestation than the right. 2. The ovum is caught in the fimbriæ, and the sac is formed partly out of the dilated mouth of the tube and partly by adhesions attached to the ovary and neighbouring structures. 3. This form is not primary. It is due to the rupture of the sac in tubal pregnancy. The partly developed fœtus escapes, and is enclosed in a new sac formed by adhesions. The placenta, however, retains its original hold of the tube. 4. The ovum is caught in the uterine part of the tube. This form requires no consideration in this place, as the condition presents no features of surgical interest.

Prognosis.—The most serious risk in extra-uterine pregnancy is rupture of the cyst, and it may be said that the nearer the cyst is to the uterus the greater is the risk of rupture. Thus it happens that rupture is most common in tubal pregnancy, whereas in the tubo-ovarian and abdominal forms the patient may go on to the full term. In the tubal form the sac enlarges up to the second or third month, when rupture most commonly takes place. The symptoms before such rupture are usually negative, and are merely those of pregnancy. The rupture is in nearly every case fatal from hæmorrhage. The rent may be, however, so placed that the fœtus finds its way between the layers of the broad ligament, or it may pass into the peritoneum and lead to an abdominal gestation. In instances (and they are chiefly tubo-ovarian or abdominal) where early rupture does not take place, the patient may go to the full term without conspicuous trouble. The manifestations of labour may then come on, and after awhile subside. The child dies and the tumour shrinks. When this has occurred the fœtus may atrophy, may remain quiescent, and cause no further trouble. In other cases, upon the death of the fœtus, no matter at what period, the sac inflames, and a fatal peritonitis follows; or the sac may suppurate, and the remains of the fœtus be discharged through an opening in the abdominal wall, or through the vagina, rectum, or bladder.

The precise **prognosis** has been carefully displayed by Mr. Hutchinson in an analysis of 102 cases.

In twenty-one of these the fœtus remained quiescent for the rest of the patient's life.

In thirteen it set up such irritation as led to death. In some cases the mother died during spurious labour, or a short while after, while in other instances peritonitis followed upon the death of the fœtus. In none of these cases had suppuration taken place.

In twenty-nine cases the fœtus was discharged piecemeal through a suppurative opening in the abdominal wall. Of this number, twenty-five recovered and four died.

In twenty-three instances the disintegrated fœtus was discharged by suppuration through the vagina or rectum, with twenty recoveries and three deaths.

In sixteen cases a laparotomy was performed, early and before suppuration had set in, with the result that ten died and six recovered.

Diagnosis.—The question of diagnosis is tersely discussed by Dr. Robert Barnes in the following words:

Tubal gestation. — "The physical signs taken alone might not enable us to distinguish an early tubal gestation from a small ovarian cyst or a tubal dropsy. But add to these physical signs, so similar in both cases, the history and signs of pregnancy, the pain and the hæmorrhage, and we get an accumulation of evidence which, in some cases at least, amounts to a very high degree of probability in favour of tubal gestation. Three conditions there are which are most likely to be a source of difficulty. Retroversion of the gravid womb; a small ovarian cyst; retro-uterine hæmatocele. The first and third of these conditions will commonly cause retention of urine, an accident which seems comparatively rare in tubal gestation. In the first, almost constantly there is a history of pregnancy, and the characteristic signs of it; in the third also there may be a history of pregnancy. Retroversion may be distinguished by tracing the firm, rounded body of the uterus by vaginal and rectal touch, and by its other characteristic signs. Retro-uterine hæmatocele may be the result of abortion. But the mass of blood behind the uterus will have followed on severe symptoms suddenly produced, and the uterus will present a degree of development much less than that commonly observed in tubal pregnancy. Although a small ovarian cyst may also cause retention of urine it does not cause suppression of menstruation."

Tubo-ovarian and abdominal gestation.—"Ovarian tumours are occasionally irregular in shape and present hard projections, which, if the mind be occupied with the idea of pregnancy, are readily mistaken for fœtal limbs. . . . In the abnormal gestation the abdomen is generally less tense than in normal gestation; it is expanded transversely; the umbilicus is often strongly drawn in. If the fœtus is living, its movements may be felt more distinctly, and are often more violent than in ordinary gestation.

"The placental *souffle* is said to be rarely heard. . . . The os uteri may feel like that of a pregnant uterus, the cervix being open. The body of the uterus is likely to be deflected to one side, and possibly fixed by adhesions. This fixing of the uterus, infinitely rare in uterine gestation, would raise a strong presumption in favour of extra-uterine gestation. In almost all these cases the uterus is elongated. When the fœtus is dead the abdomen sinks; the breasts fall; the uterus resumes its ordinary state, remaining, however, somewhat above its normal length. The history will help. The subject will have been conscious of being pregnant. There will probably have been indications of peritonitis. Usually the liquor amnii is absorbed . . . . If there is fluid enough in the cyst, the fœtus may be felt to gravitate on putting the patient into the knee-elbow posture."

Treatment.—The treatment of extra-uterine gestation presents many points of difficulty. It may be considered under the following conditions:

1. *The sac has suppurated.*—In such a case, the period when rupture is most likely to occur will have passed; possibly the full term has been passed, and the fœtus will have been some time dead. The sac should be opened under antiseptic precautions, through an incision in the anterior abdominal parietes over the most prominent part of the tumour. The wall of the sac, if not already adherent to the parietes, should be

attached thereto; the fœtus should be removed: the placenta should not be interfered with if still adherent; the sac should be washed out, well drained, and treated as an abscess cavity. Considerable success has attended this measure.

2. *The full term has passed, but no complications have arisen.*—In such case, the manifestations of labour will have set in and have again disappeared, the fœtus will be dead, and the tumour probably have diminished in size. There is a prospect that the fœtus and sac will atrophy and remain quiescent. No operative treatment should be adopted until symptoms arise. When inflammatory manifestations have set in, the sac should be opened and treated in the manner just detailed.

3. *The condition is diagnosed at an early period.*—Here the real difficulty arises. Shall a laparotomy be performed at once, or shall the tumour be left alone? If left alone it will, if tubal, very probably rupture. If death, on the other hand, follows laparotomy, the surgeon will be reminded of many cases that have been left to themselves and have ended in recovery. A tubal pregnancy should, on account of its great disposition to early rupture, be treated by laparotomy as soon as recognised. Tubo-ovarian, or abdominal gestation, may be left. It is unfortunate, however, that it is often quite impossible to distinguish the various forms of extra-uterine gestation from one another, so that the advice just given is more theoretical than practical. Each case must be taken upon its merits, and it must be said that the tendency of recent surgery is in favour of early operation. It must be noted, also, that the risks of the case when left alone are in excess of the risks attending the early operation.

In performing laparotomy the abdomen is opened in the linea alba, the cyst is drawn forward and incised, the fœtus is extracted, and the sac wall, if not already adherent, is attached by sutures to the edges of the wound in the parietes. The placenta should not be disturbed, and the cord should be allowed to hang out of the wound as a drain. The strictest antiseptic precautions should be adopted. The less the parts are disturbed in this operation the better.

The tapping of the cyst at an early period has been advised. The procedure is, however, uncertain, dangerous, and apt to seriously complicate a subsequent operation.

XI. INJURIES AND DISEASES OF THE TESTIS, SCROTUM, AND PENIS.

James Cantlie.

Diseases of the Penis.

The injuries, inflammations, syphilitic infection, malignant and benign growths, and congenital malformations which make up the category of disease to which the penis is liable, may be arranged into those which affect the skin of the penis, the erectile tissue, and the urethra. Urethral diseases are, however, dealt with in Art. XIII., vol. iii., and syphilitic affections in Art. XII., vol. i. Hence it is only the local conditions of disease of a kind peculiar to the part which are discussed in this chapter.

Malformation of the penis.—It is a marvel that the organ essential to the continuance of the species should be so often congenitally malformed as it is. The conditions of congenital malformations, owing to arrest in development, arrange themselves, for the most part, into two great classes, hypospadias and epispadias.

Hypospadias.—When the urethra does not end at the meatus urinarius in the glans penis, it may be so developed that it opens farther back on the under surface of the penis. When such a malformation exists it is called hypospadias. In the early weeks of fœtal life the appearance of the genital apparatus externally is that of a fissure (the urogenital), of a fold on either side, and a small eminence in front. Up to the tenth week no distinguishing feature characterises the male or female, but after that date the parts undergo a series of changes.

In the female the parts retain the rudimentary idea of a fissure, the entrance to the vagina; the two folds becoming the labia majora; and the eminence develops subsequently into the clitoris. In the male, the fissure as a fissure becomes obliterated, but its continuance is found as the male urethra; the lateral folds melt together along the middle line, forming the scrotum, the bulbous and spongy portions of the corpus spongiosum, and enclose the urethra; the small eminence in front becomes the corpora cavernosa of the penis. When in the development of the male organ the lateral folds do not come properly together, the urethra may open at different points along the under surface of the penis, according to the point of the arrest in development; hence it may open immediately beneath the glans (*balanitic hypospadias*); or two or three inches back (*penile hypospadias*); or it may end in the perinæum, the scrotum being cleft and the urethral aperture existing at the root of the penis (*perineal hypospadias*).

The *appearance* of the organ will depend on the seat of the aperture; but wherever the urethral opening may be, the part in front of it is deficient in the spongy tissue of the organ, while a band of inexpansile fibrous tissue represents the area of its absence. The chief reason for surgical interference in this disease is not incontinence of urine, because the patient is not so troubled, nor is there any real difficulty in passing urine; but owing to the urethra opening in the perinæum, procreation is impossible.

The *treatment* of hypospadias is unsatisfactory in the extreme. Plastic operations of many kinds, ingenious and skilful, have been devised and practised. It is beyond the scope of this article to discuss the matter even shortly. Suffice it to say, that an attempt at the formation of a urethral channel may be made by dissecting a flap of skin on one side of the under surface of the penis, so that its cutaneous surface may, when it is reflected, be towards the intended channel. A second flap is then dissected from the other side of the under aspect of the penis, and made so that it can be applied over the raw surface of the previous, and fixed by sutures.

A peculiar form of malformation is when the penis is tied down to the middle line of the scrotum by a frænum of skin. This condition can be cured by releasing by incision the penis from its scrotal attachment.

Epispadias.—By epispadias is meant a deficiency of the upper wall of the urethra, often associated with extroversion of the bladder. The urethra is seen as a groove upon the *upper* surface of the penis, in a funnel-shaped opening. When implicating the glans it is named balanitic; when incomplete, spongio-balanic; and complete, when it is complicated with extroversion of the bladder.

Like hypospadias, it is due to imperfect development, the mass of tissue surrounding the inner and upper part of the uro-genital fissures failing to be developed into the corpus spongiosum. The urethra therefore opens upon the upper surface of the united corpora cavernosa. The penis is always imperfect, and sometimes bound down to the anterior part of the scrotum.

In extroversion of the bladder (ectopion vesicæ) the pubes do not meet at the symphysis, the anterior wall of the bladder is absent, and in consequence the posterior wall, showing the opening of the ureters in the midst of a red granulation-tissue-looking mass project at the upper surface of the root of the penis. The treatment of ectopion vesicæ is given in Art. XIII., vol. iii. When the attempt is made to continue a channel for the urine forward, from the root towards the point of the penis, a plastic operation is necessary, in which a flap of skin is turned down from the abdomen, with its cutaneous surface towards the proposed channel, and its raw upper surface covered by flaps derived from the penile or scrotal skin.

Phimosis is a malformation of the prepuce, of such a nature that the opening is narrowed and the prepuce itself more or less elongated.

Etiology.—Phimosis may be congenital or acquired. Longitudinal phimosis, of slight severity, may be much intensified by inflammation, thus leading to a mixed form of phimosis. The acquired is induced by repeated attacks of inflammation, balanitis, herpes, etc., or it may be specific (gonorrhœal, hard or soft chancre).

Pathology.—When from one of these causes the prepuce becomes narrowed, so that it cannot be retracted over the glans, accumulation of secretion occurs between the prepuce and the glans, or the urine may lodge between them, causing irritation and inflammation. Adhesions may take place between the glans and the prepuce, or the urine salts may be deposited, causing calcareous concretions to be formed in the same locality. So narrow may the orifice be that, during micturition, the prepuce is distended, like a bladder, with urine that cannot escape at the same rate it escapes from the urethra, because of the narrow preputial opening.

The *results* and dangers of phimosis are : penile irritation, giving rise to reflex paralysis, vesical irritation, retention and incontinence of urine. Prolapse of the rectum is not an infrequent accompaniment ; also, as already stated, balanitic adhesions between the glans and its covering. The inflammation may be so intense that it may end in gangrene of the parts. Sores may be hidden, warty growths developed. Habits of masturbation may be induced. Coition becomes difficult or impossible. Lastly, the greatest danger is that this morbid condition induce the evolution of epithelioma.

Treatment.—This will depend upon the condition of parts when seen by the surgeon. If there is an acute condition of inflammation, incisions of any kind would be out of question, because of the danger of septic infection The inflammation must be allayed by suitable applications, and the space between the prepuce and glans must be frequently washed by syringing with disinfectant lotions. Especially must care be paid to this if there be sores present. Should the prepuce threaten to slough, the best thing is to make one or two incisions, to relieve tension, or the entire prepuce may be slit up on a grooved director.

The treatment for the cure of phimosis will vary with the degree of contraction. When this is slight, daily retraction of the prepuce will answer all purposes. If the constriction be confined to the margin of the prepuce, and this be not too long, or if it be thought advisable to expose a sore, simply slitting up the prepuce may be sufficient. To do this (an anæsthetic having been given), introduce a grooved director between the prepuce and the dorsum of the glans, nearly as far back as corona. Make the end of the director project at the skin on the dorsum of the penis, cut down on its point with a Syme's bistoury, and run it along the groove in the director, incising the tissue towards, instead of away from, the margin of the prepuce. This will prevent the prepuce slipping off the director, as it has a tendency to do when cut from the margin of the prepuce upwards.

It may be preferred to remove the prepuce after it has been slit up; for this purpose a circular sweep commencing at one end of the slit and continuing to the other should be made; thus, practically, performing circumcision.

When the prepuce cannot be retracted, and, perhaps, in all well-marked cases of congenital phimosis, circumcision had better be resorted to.

Circumcision.—The removal of the prepuce is an operation of great antiquity, and one which seems, when early performed, as it is according to Jewish and Mohammedan customs, to give rise to little trouble. The surgeon, however, is seldom called upon to perform the operation unless some untoward symptom has developed. Probably this is the reason why troublesome or even dangerous complications are apt to arise in the most skilful surgeon's hands.

Of the many methods of operating the following is as safe as any. Seize the prepuce opposite the corona between the handles of a dressing forceps, fixing the handles, if there is no catch, by a piece of strapping. The glans retracts and the forceps closes on the prepuce in front of the glans. With a sharp scalpel cut off all the structures in front of the forceps. Now undo the forceps, when it will be seen that the skin is cut obliquely, and that the skin retracts leaving the mucous aspect of the prepuce still encircling the glans penis. Beneath this pass a director and cut down upon it, or pass one blade of a scissors and cut upwards as far as opposite the corona. Now reflect the whole of the mucous aspect, by separating it from the glans with the thumbs, until it is quite free all around. Stop hæmorrhage by tying or twisting the larger vessels, and by exposing the surface for a time; the smaller vessels will cease naturally. Except in children of a few months old, it is necessary to stitch the reflected mucous surface to the cut edge of the skin by horse-hair, silk, or fine wire sutures, continuous or interrupted, according to the fancy of the surgeon, or the nature of the resulting skin wound. The parts should then be smeared with vaseline, or dressed with warm boracic lotion.

During the operation beware of removing too much skin; of leaving the mucous aspect of the prepuce undivided; of passing the director or the point of the scissors blade in the meatus and cutting the glans. The last, curious as it may seem, is the most frequent mistake made during the operation.

The *after dangers* are: Hæmorrhage, which may appear within twenty-four or forty-eight hours from a violent erection, tearing open the wound and the blood-vessels; or hæmorrhage may come on long afterwards, when an extensive wound, with profuse granulations, begins to ooze. The hæmorrhage must be combated in the usual way by tying, torsion, or styptics; or a catheter may be passed and the penis tightly bandaged thereto, until the hæmorrhage is restrained. A large cicatrix may result, causing a preputial stricture behind the corona. The resulting cicatrix may be so tender in adults that copulation may be painful or impossible.

Paraphimosis is the name given to the series of phenomena induced by the constricting influence of a narrowed prepuce when retracted over the glans.

Etiology.—A narrowed prepuce, congenital or acquired, is drawn backwards behind the corona glandis, either purposely, accidentally, or during coition. In men who have a naturally retracted prepuce, a slight swelling from venereal disease may be sufficient to cause constriction.

The result of this constriction is congestion, impeded circulation, swelling, effusion of serum, and œdema; then follows strangulation, ulceration, or, may be, sloughing of the penis, or skin, or both. Sometimes the constricting band is completely hid from sight.

The signs and symptoms will vary with the cause, the duration of the constriction and the tightness thereof. On inspection a large roll of swollen mucous membrane is seen immediately behind the corona, with a deep sulcus behind it, between it and a second but a less markedly swollen encirclement. The constriction corresponds to the sulcus.

The *treatment* consists in removing the constriction, either by restoring the prepuce to its normal position, or, if this be impossible, by dividing the constricting band. For the former purpose, the penis should be grasped behind the constriction, between the first and second fingers of each hand, and an endeavour should be made to draw forward the prepuce, making very firm pressure at the same time over the glans with the thumbs. The swelling may have been previously reduced by making pressure with a bandage, or by making punctures in the swollen part to let out serum.

If it is not possible to reduce the paraphimosis in this manner, the stricture band must be divided. To do this, it must be remembered that the preputial orifice causing the strangulation is between the two folds of swollen tissue already mentioned. To divide this, cut directly upon it after pulling forwards the glans and anterior fold, an assistant steadying the skin at the root of the penis; or slip the point of a sharp-pointed bistoury beneath the constriction and cut outwards. In all severe cases it is best to give an anæsthetic.

The after-treatment will consist in applying hot fomentations until the swelling goes down, and carbolic or some simple lotion until any slough has come away, or any sore has healed.

Herpes may occur on the glans or prepuce; most frequently the latter. The small vesicles containing first clear, then purulent, fluid can hardly be mistaken. The treatment consists in frequent ablutions, and the application of zinc ointment. In special cases, such as in gouty subjects, colchicum, quinine, or arsenic may be essential to allay pain and promote cure.

Hypertrophy of the prepuce is sometimes found as the result of simple chronic inflammation of the part, producing an enlarged and solid œdematous condition of the prepuce and the skin of the body of the penis. In other cases it is the result of elephantiasis or varix lymphaticus, and may grow to a formidable size.

Treatment.—In the simple cases circumcision may be required; in worse cases it will be necessary to dissect away the skin from the glans penis.

Warts are frequently found on either the glans, or prepuce, or both. They may follow balanitis, gonorrhœa, or a chancre, and are due to a hypertrophy of the papillæ of the skin and their epithelial covering; such hypertrophy being directly caused by the constant irritation of the mucous surfaces, set up by the presence of unhealthy secretions. These warts, red and vascular in appearance, may increase very rapidly, both in size and in number, giving a cauliflower appearance to the part.

Treatment.—Warts may be removed by scissors, and the roots afterwards touched with caustic or dusted with calomel. When the foreskin cannot be retracted, it will be necessary to slit it up previous to removal. The tendency to recurrence is counteracted by cleanliness and hardening the surface by dusting the retracted prepuce and glans with oxide of zinc powder.

Balanitis.—An inflammation of the prepuce on its inner surface may be set up by (*a*) retained secretions; (*b*) gonorrhœa; or (*c*) herpes. The prepuce is reddened, swollen, painful and tender, and a mucopurulent discharge is exuded.

The inflammation is generally confined to the prepuce, but it may implicate the glans, constituting *posthitis.* Care must be taken that the affection be not mistaken for a specific sore, or *vice versa.*

The *treatment* is very simple; frequent washing with a warm carbolic lotion, and the application of lint soaked in lead lotion around the glans will soon cure the inflammation. Sometimes it may be thought advisable to pass a stick of nitrate of silver rapidly round the sulcus, between the glans and the retracted prepuce. A saline aperient mixture may assist in the curative process.

Chronic inflammation of the corpora cavernosa is an affection of the erectile tissue of these bodies. Its cause and pathology are obscure; probably in nearly all cases it is somehow connected with a gouty diathesis, and may or may not be the result of slight injury. When affecting the sheath of the corpora cavernosa, it gives little pain, but interferes with the perfect erection of the penis, and may be felt as a flat induration beneath the healthy skin. When affecting the erectile tissue there is a condition of things very much like phlebitis, the venous spaces being filled with exuded material and coagulated fibrin; it generally occurs in patches, and can be felt as one or more hard nodules.

Treatment is of little immediate good. Mercurial ointment or tincture of iodine applied to the part, and the usual anti-gout remedies may be tried.

Gangrene of the penis as an idiopathic affection is rare; it occurs during fevers now and again (typhus, typhoid, small-pox). In these cases the penis is generally shrivelled, dry, and black. In nearly all cases the gangrene is the result of injury or inflammation, such as severe phimosis with soft sores, balanitis, etc.; syphilitic phagedæna, strangulation from ligature, or paraphimosis. Extravasation of urine is not an infrequent cause.

The *signs and symptoms*, such as dark or wash-leather-like patches, the offensive discharge, etc., are unmistakable. The danger is great on account of the peculiar structure of the penis, and its liability to hæmorrhage during the separation of the slough. Separation proceeds rapidly; the line of demarcation appears from the eighth to the twelfth day.

Treatment.—This demands nothing peculiar, but must be conducted on general principles. In many cases the cause is a local one, and may admit of easy removal (paraphimosis or ligature). In other cases free incisions to relieve all tension should be made. In phagedæna apply nitric acid freely. Warm and anodyne applications should be used to facilitate the healing process. Great care must be exercised to keep the part as clean as possible, and means taken to support the patient's strength by careful feeding, tonics, etc.

Cancer of the penis. — Carcinoma of the squamous epitheliomatous type attacks the penis. It usually commences on the dorsal aspect of the penis, behind the corona; it may, however, commence in other parts of the glans, or the deep surface of the prepuce, or near the opening of the prepuce, especially in patients who are the subjects of phimosis. It may also extend from the scrotum. One or two cases have been described where it had its origin in the urethra, and others where it started in a stricture or fistula of the urethra. No other kind has been described and verified by microscopic examination, except a case by Mr. H. Coote, of primary infiltrating cancer of the body of the penis having all the histological characters of scirrhus.

Etiology.—The primary cause is obscure. It appears generally between the ages of 45 and 70, and is rare before 45. It often has its starting point in a centre of irritation; hence phimosis, venereal sores, chancres, warts, cicatrices of sores, are sometimes the precursors of cancer.

Signs and symptoms.—Carcinoma of the penis commences either as an irregular, warty growth, a hard, flat tubercle, a pimple, or an indurated, excoriated sore. In whichever manner it commences ulceration soon takes place, giving rise to a hard, indurated and painful sore, having a fœtid, ichorous discharge, and often bleeding. It extends irregularly in all directions. The cavernous tissue of the penis soon loses its characteristic structure, being replaced by the greyish, cancerous growth. The urethra, at first but little encroached upon, is afterwards invaded by the growth, and so blocked up that a fistulous opening may take place farther back in the penis. Next the inguinal glands become infected, the rapidity with which this takes place depending upon the rapidity of ulceration and upon the facility with which the products of the ulceration can escape. At first the glands are simply enlarged, but soon they become painful and tender; finally ulceration sets in.

So the case goes on from bad to worse. The general condition of the patient is affected; he becomes worn down with pain, anxiety, and the baneful influence of the malignant disease. General infection is more slow than in cancer of other organs.

Diagnosis.—In the early stages one has to distinguish between (*a*) a benign and cancerous wart; (*b*) cancerous induration and induration of a chancre; (*c*) simple ulceration and malignant ulceration; (*d*) cancerous and syphilitic sores. In all cases it must be remembered that cancer is a new growth succeeded by ulceration. Induration precedes and accompanies cancerous ulceration; but in benign growths and ulcers there is no induration. So, in a malignant sore there is a hard base and indurated margins, the edges are raised and everted, bleeding frequently occurs, and the ulcer exudes a sanious, ichorous discharge. Syphilitic ulcers and indurations cannot always be diagnosed; but the history of the case and the effect of medicines are safe guides to go by.

Treatment.—Many cases have been known to live years without any return of the disease after successful extirpation. In this respect, perhaps, cancer of the penis is more favourable for prognosis than cancer troubles usually are.

The treatment, of course, will vary with the extent of the disease and the condition of the inguinal glands. No time should be lost in removing the least doubtful growth (wart or tubercle), either with nitric acid, acid nitrate of mercury, or, best of all, by the knife. In a doubtful syphilitic sore large doses of potassium iodide may be given; but, if there be no improvement, excision of the part should at once be performed. Where the growth cannot be removed by a less simple operation, amputation of the penis must be undertaken.

Amputation of the penis.—When the anterior part of the penis is to be amputated, provision must be made for prevention of hæmorrhage by either tying a clove-hitch of tape well behind the line of amputation, or by the application of a Clover's clamp. Care must be taken that too much skin is not removed, so it is necessary to pull the skin backwards towards the root of the penis before applying the tape or clamp. The point of the penis is then wrapped round by a piece of lint, and the surgeon may by oblique incision from above downwards remove the diseased part by one cut. This incision, although made obliquely, the lowest part being the longest, cannot be so carefully judged as is desirable; hence it is better to cut through the corpora cavernosa first, and the spongiosum afterwards; and, to ensure still more accuracy, it is best in the first instance to pass a catheter, and transfixing the penis between the corpus spongiosum below and corpora cavernosa above, cut upwards through the corpora cavernosa. The corpus spongiosum can then be cut to any length desirable; usually three-quarters of an inch is required. The urethra and corpus spongiosum are now slit towards their upper lateral aspects, and the edges stitched to the skin below and the penile tissue above by catgut or Chinese silk sutures.

To prevent retraction of the urethra beneath the stump and subsequent constriction it is recommended that antero-posterior skin flaps be made. The anterior flap is to be made much the larger to allow it to fall over the stump of the cut penis. The corpus spongiosum being cut longest, is brought through a hole made in the anterior flap; the urethra is then stitched to the margins of the hole, and the flaps are neatly united below. The galvanic cautery is not an instrument to be recommended; it is best to incise the skin and the corpus spongiosum before applying the instrument.

When it is necessary to remove the *whole* penis, shave the parts around; make an elliptical incision around the root of the penis; dissect the crura from the rami of the pubes and ischium; cut through the urethra at the back part of the bulb, and stitch the cut urethra to the margins of the skin.

After amputation the vessels must be tied, the dorsal arteries first, the arteries to the corpora cavernosa next, and any other which may be found in the septum pectiniforme or in the skin.

Great care must be taken to keep the wound clean and aseptic, as the spongy erectile tissue is particularly prone to absorb septic material; washing with solution of zinc chloride or carbolic lotions, and the application of iodoform. Bismuth subnitrate in powder, or boracic dressings are elegant applications.

When the glands are enlarged they should be carefully dissected out. Everything should be done to strengthen the patient and make him comfortable.

Other **growths of the penis** only need mention here, viz. nævi, fibro-cellular and fibrous tumours, cysts, etc. Horny excrescence may be mentioned as a pathological curiosity.

DISEASES OF THE TESTICLE AND SCROTUM.

Abnormalities of the testis.—To follow the various diseases and abnormalities with understanding, it is necessary first to remember that the testicle is at first an abdominal viscus; that up to the seventh month of fœtal life the testicle lay below the kidney, but at the beginning of that month it began to descend, until, by the end of the eighth month of fœtal life, it had travelled through the abdominal wall and reached the scrotum. The testicle itself is developed on the inner aspect of the Wolffian body, the seminal ducts from the tubes of that body, and the vas deferens from the duct of the same. Such being the developmental history, the following irregularities will be understood.

(*a*) The testicle may fail to be developed, or be obliterated, and therefore be absent.

(*b*) The testicle may be developed, but the vas deferens fail in its whole extent or in part.

(*c*) The testicle may be perfect, and the vas deferens also, but, through some failure in the tubules of the Wolffian body, the testicle remains unconnected with its duct.

The testicle may be *undescended* or descend into an abnormal position; in the abdomen it may remain near the kidney or at the internal ring; externally it may remain in the inguinal canal or at the external ring. It has been known to descend into the crural canal and into the perinæum. In some instances a cause may be found for the retention such as (1) abnormal adhesions; (2) the meagre size of the internal or external abdominal rings; (3) abnormality in the size of the testicle, either too large or too small; (4) malformations of the genital organs. With undescended testes impotence does not of necessity follow.

Diagnosis.—With ordinary care an undescended testis may be distinguished from a hernia in the form of a bubonocele, and from such conditions as hydrocele of the cord. If the testicle be not in the scrotum, but in the inguinal canal, then can it be felt as a nodule with definite outline, movable, and giving the sensation on pressure peculiar to the organ. If not in the scrotum or in the inguinal canal on either side, then is it known to be in the abdomen, and healthy, should the man beget children. It may happen, however, that the testicle is in some one or other of the abnormal positions mentioned. A testicle in the inguinal canal is liable to diseases such as inflammation, sarcoma, or other morbid growth. In addition, an undescended testis may be complicated by hernia or hydrocele. Hernia, when reducible, is easily diagnosed; so is hydrocele by its fluctuation; but an inflamed retained testicle and a strangulated hernia are more liable to be mistaken. In such cases reliance must be placed on the history, constipation, sickness, the character of the pain, and the associated signs and symptoms of strangulated gut.

Treatment.—The treatment of a testicle retained in the inguinal canal depends on many things. If it is inflamed, then must the remedies recommended for orchitis be employed. If it is complicated with hernia, then must a horse-shoe-shaped pad be accurately fitted to repress the hernia and leave the testicle free. Should malignant growth attack the organ, it must be removed. Finally, should it be desirable, the testicle may be cut down upon, and the tissues around it stitched to the bottom of the scrotum, in the hope that traction will by-and-by bring about a normal state of things.

HYDROCELE.

In the widest acceptation of the term, hydrocele signifies a fluid effusion, in connection with either the testicle or cord, be that effusion simple or inflammatory. The division of hydroceles into simple and encysted is hardly in harmony with precise pathology; hence it is intended to place all encysted hydroceles in the class "spermatic cysts," to be discussed farther on. Inflammatory fluid effusions within the serous coverings of the testicle or cord are dealt with when considering the diseases which give rise to them, whether simple orchitis, syphilitic orchitis, etc.

Hydrocele of the tunica vaginalis is a collection of serous fluid in the covering of the testicle, derived from the peritoneum. It may be: 1. Simple. 2. Congenital, when the funicular process of the peritoneal prolongation with the cord and testicle (the processus vaginalis) remains unobliterated, allowing of direct communication between the peritoneal cavity and that of the tunica vaginalis. 3. Infantile, when the funicular portion of the processus vaginalis is closed at the internal abdominal ring only. 4. Serous fluid may accumulate in the partially obliterated sac of an old hernia.

Etiology.—It has been a matter of discussion how far hydrocele is due to inflammation, and how far it is of the nature of a dropsy. That it is inflammatory in origin appears from the following facts: (*a*) it frequently occurs in acute inflammation, or in syphilitic affections of the testis; (*b*) the fluids in dropsy contain less albumen than hydrocele (four per cent. in the former, six per cent. in the latter); (*c*) hydrocele fluid sometimes coagulates spontaneously, and always contains fibrinogenous material, whilst the opposite obtains in dropsical fluids; (*d*) in hydrocele there is often a history of inflammation, whilst there is no such history in dropsy; (*e*) finally, hydrocele is rarely found in connection with general dropsy. It is possible, on the other hand, that the disease may commence as a passive effusion, and the presence of this abnormal fluid may set up inflammatory changes of a low kind.

Pathology.—The fluid is usually of a pale straw colour, quite transparent, with a sp. gr. 1030, and loaded with albumen. This latter fact is made plain either by heat or nitric acid. Sometimes the fluid coagulates spontaneously when withdrawn, probably by the escape of a few blood corpuscles into the fluid from the puncture made in the skin by the tapping process. In older cases the fluid is thick, treacly, and dark in colour. It may contain cholesterine in such quantity as to give a shimmering, opalescent covering to the fluid, when it cools after withdrawal. It may also contain blood or spermatozoa, from the rupture of a vein or a spermatic cyst respectively. In some cases fibrinous loose bodies may be met with in the cavity of the tunica vaginalis.

The *wall of the sac* in recent cases is but little thickened, and its internal surface retains a smooth appearance. In cases of long standing, or in those which have undergone frequent tappings, the sac wall becomes more vascular and thickened, the internal surface less smooth, being frequently spotted with vegetations; the connective tissue of the wall is increased in quantity, arranged in layers, and much more fibrous than normal. Later on, this thickened and condensed wall may be sclerosed, having a density and hardness almost like cartilage.

Frequently growing from the visceral portion of the tunica vaginalis are small bodies of about the size of peas, sessile, or sometimes attached by a long pedicle. Microscopically, these are composed of somewhat laminated fibrous tissue, but, on the other hand, they may become calcareous.

Simple hydroceles are usually pyriform in shape, but there may be some adherent points, the one surface to the other, giving various shapes to the swelling (constricted, hour-glass shape); or one portion may be quite separated from the other, two cavities being formed.

Signs and symptoms.—Simple hydrocele presents a smooth, pyriform swelling, the base being downwards. It may be soft or tense; fluctuation can be obtained, and translucency is usually present, except in old cases where the walls or the fluid is thickened.

To discover the translucency, the scrotal tumour should be grasped firmly behind and above, and a light held on the opposite side to the observer, close to the scrotum. Assistance may be had by looking through a tube made of paper, or a stethoscope. The testicle is usually placed behind, and a little below the middle of the tumour; in old cases it may be slightly atrophied. Hydrocele for the most part either occurs in infancy or middle age.

Diagnosis.—Hydrocele of the tunica vaginalis has to be distinguished from hernia, hæmatocele, spermatic cysts, and solid or cystic tumours of the testicle. Hernia is diagnosed from hydrocele by the neck of the hernial protrusion being in the inguinal canal; but, when the hernia is reducible, by its being capable of being pushed back into the peritoneal cavity; by the history of the growth in that it grows from above downwards, whereas a hydrocele accumulation develops in an opposite direction. Hernia is resonant on percussion when intestinal; it never fluctuates, nor is it translucent. The testicle is always at the bottom of the hernial protrusion, whilst the opposite conditions exist in hydrocele. Where the hernia is omental no mistake can be made, if its lobulated character be remembered. Where there is any doubt a careful antiseptic incision will reveal the truth.

Hæmatocele has no translucency, is heavier, and the fluctuation is obscure; then also will the history of the case be of importance.

The diagnosis from tumours of the testicle can only be obscure when the walls of the sac or the contents are so thick that they simulate a solid growth. The history of the case must then be relied upon, or an exploratory incision must be made.

In spermatic cysts the tumour is of a globular shape, and the testicle is usually below and behind.

Spermatic cysts.—Cysts of the testicle or epididymis (encysted hydrocele of the testicle of most authors). These will be considered as (A) cysts of the surface of the testicle, (B) cysts of the epididymis.

(A) **Cysts of the surface of the testicle** are very rare. Single, and small in size, they are but rarely of practical importance. They are found *on* the anterior surface of the testicle, between the serous coverings and the tunica albuginea; some few have been described as occurring *in* the layers of the tunica albuginea. It is thought they may have taken origin by an encapsulation of extravasated blood. They must not be mistaken for cystic disease of the testicle itself.

(B) **Cysts of the epididymis** are found as two kinds, viz. (1) small subserous cysts, and (2) spermatic cysts proper.

1. *The small subserous cysts,* found on the epididymis beneath the serous layer are only of pathological importance. They never occur in young people, but increase after forty years, as age advances.

Never larger than a pea, they are sometimes pedunculated, sometimes sessile; the cyst wall, usually thin, contains yellow, limpid, or opalescent fluid, but never spermatozoa.

2. *Spermatic cysts* proper are found most frequently about the head of the epididymis, or between it and the upper border of the testes, and grow out from amongst the ducts, especially the vasa efferentia.

Although usually single, nevertheless two or more may be found together. The cyst walls are composed of delicate connective tissue, sometimes showing plane muscular fibre, and lined by flattened columnar epithelial cells. The contents are limpid, opalescent, or milky. Albumen is not usually present, but chlorides and phosphates are found in quantity. The most remarkable thing is the presence of spermatozoa; in most cases these are alive and active, in others they are defunct and partially decomposed (Fig. 40).

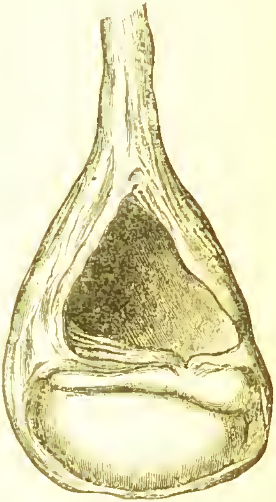

Fig. 40.—Spermatic Cyst. (Lond. Hosp. Museum.)

Their *origin* can only be briefly discussed here. They are variously believed to be: (*a*) Dilatation of seminal tubes; (*b*) rupture of a seminal tube, the extravasated matter becoming encysted; (*c*) primary cystic formation, having a seminal tubule afterwards communicating with it; and lastly, (*d*) embryonic remains may undergo development in after life; *e.g.* the organ of Giraldes; hydatid of Morgagni (Müller's duct); vas aberrans of Haller.

In whatever way originating, there is formed a slowly-growing swelling, having the testicle usually below and in front. The swelling may be smooth or irregular, tense or bossy; with a sac wall, thin and translucent, or thick and so rendering the diagnosis difficult.

Treatment of hydrocele and spermatic cysts.—The treatment is divided under two heads, palliative and curative.

Palliative treatment consists in external applications of evaporating lotion, or stimulating and irritating paints, as iodine and the like; wearing a suspensory bandage to prevent the dragging sensation; and finally tapping the hydrocele when it is sufficiently advanced.

Tapping a hydrocele. — Select a trocar and ascertain that it is well made and clean. The patient is to be placed in a good light, either standing straight up with his back to the wall, or reclining on a couch. Dip the trocar and canula, separately, into carbolised oil before commencing. The surgeon now grasps the scrotum with the left hand, making the swelling tense and light. The surgeon's forefinger of the left hand should be touching the testicle as the hand grasps the scrotum. The trocar is now thrust into the scrotum at a spot in front, and at the lower part, of the swelling, taking care to avoid the superficial veins. The trocar is pushed smartly through the skin in a direction directly backwards at first, but when the skin is punctured it should be carried upwards for a short distance, the trocar being withdrawn from the canula whilst such is being done. The fluid is now allowed to run off and the scrotum gently compressed towards the end of the flow. The canula is then withdrawn, the orifice is pinched between the finger and thumb, the parts around are wiped, and a piece of strapping or collodion is applied. A suspensory bandage should be applied immediately afterwards and worn some time. It is but seldom untoward consequences result from tapping, but now and again, especially in the thick-walled sacs of old men, the whole of the sac wall may slough, involving also the skin of the scrotum.

Curative treatment.—Of the various methods employed the injection of irritant fluid is the most practised at the present day; but, besides this method, we have antiseptic incision, the introduction of setons, and acupuncture.

1. Injections are thrown into the cavity of the tunica vaginalis with the purpose of restoring the balance of secretion and absorption to the serous surfaces of that membrane. Most frequently, however, this treatment ends by causing adhesions between the parietal and visceral surfaces (Fig. 41).

A great variety of substances has been used, viz. port wine, carbolic acid, sulphate of zinc, iodine, nitrate of silver, etc. As iodine is the most certain of any of these, none of the others need be considered here.

The method in general use is as follows: the fluid of the hydrocele is first drawn off, then about two to four drachms of tincture of iodine, pure or diluted with half water, is syringed in by a glass syringe. The canula used should be made of platinum, and not of silver, as the iodine solution will not corrode the former as it does the latter. Beware of the nozzle of the syringe not fitting the canula.

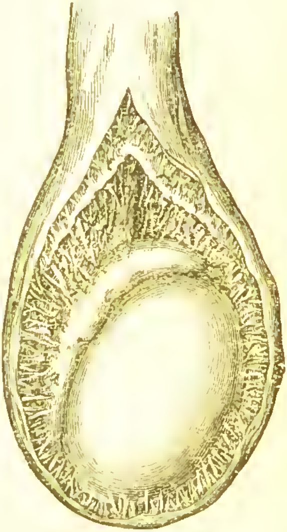

Fig. 41.—Sac of Vaginal Hydrocele obliterated by adhesions after injection with iodine. (Lond. Hosp. Museum.)

After injecting the iodine, the canula is plugged, and the injection allowed to remain about ten minutes, care being taken to bring it fully in contact with the whole surface of the cavity. After this period of time the whole fluid may be allowed to escape, or half of it may be retained. The patient ought to be made to lie up for two or three days after the operation. Succeeding this form of treatment a considerable irritation and inflammation may develop. Under such circumstances the usual anti-inflammatory applications are to be applied.

The hydrocele fills rapidly during the inflammation after injection, but at the end of a week or ten days as rapidly subsides. A suspensory bandage should be worn, and subsequently strapping the swelling is very useful.

2. Seton is only used in exceptional cases, *e.g.* where iodine has failed ; it often sets up an alarming amount of inflammation.

3. Antiseptic incision is performed where injection has failed, or when the patient is so feeble that sloughing of the scrotum is feared. It is more certain in its results, and complete cure is earlier obtained than by any other method.

The operation is performed under an anæsthetic by making an incision, after shaving the skin, about two inches long in the anterior and lower part of the tumour, and allowing the fluid to escape. Then a few carbolised catgut sutures are introduced, and a drainage tube is laid in the wound, when the whole of the genital organs are wrapped up in dressings, a hole being made for the penis. This may be removed and re-applied every four days. The patient may get about in a fortnight, and the parts will probably be healed in three weeks or a month. This treatment is certainly best in old men, especially with a very thick cyst wall, or where there is the complication of hernia.

Spermatic cysts are best treated with injection of iodine.

Congenital hydrocele, as already stated, is peculiar in that its cavity and the cavity of the peritoneum communicate. The only difficulty is to diagnose it from hernia. Translucency is the most important sign, a hernia never being translucent. Again, the sudden manner in which a hernia slips back and with a gurgling sound, as compared with the slow manner in which the hydrocele is reduced. The treatment is to apply pressure by a truss over the internal ring and inguinal canal to obliterate the opening. Evaporating lotions should be applied, or iodine should be painted over the scrotum, or antiseptic incision may be advisable. In such cases injections of iodine are not contra-indicated.

Infantile hydrocele occurs early in life. It is known from congenital variety by the impossibility of squeezing the fluid into the abdomen.

The *diagnosis and treatment* are similar to the preceding.

Acupuncture, although usually considered as palliative treatment, is here classed as curative. It is performed by introducing a needle rapidly at several points through the scrotal tissues down to the fluid. Some fluid escapes externally, but most of it escapes into the cellular tissue around and is rapidly absorbed.

Hydrocele of a hernial sac is found but rarely, and can only exist when the peritoneal communication has been closed.

The fluid resembles that found in vaginal hydrocele. It resembles vaginal hydrocele in every respect, except that it extends higher up the cord.

The *treatment* is the same as for that class of cases.

HÆMATOCELE

is the name given to an extravasation of blood in the neighbourhood of the testicle or spermatic cord. It may take place in one of the cavities or cysts found in hydrocele; or the effusion may occur into the spermatic cord, scrotum, or tunica vaginalis, independently of previously existing hydrocele. In connection with this subject we have, therefore, to consider hæmatocele of the testicle, of the cord, and of the scrotum. The last two will be discussed with the affections of the cord and scrotum respectively.

Hæmatocele of the testicle may be classified as vaginal, encysted, and intratesticular.

A. *Hæmatocele of the tunica vaginalis* is the common and most important kind; it is usually the result of injury, but may occur spontaneously; in the latter case it is probably due to diseased vessels, or to some changes in the inner surface of the tunica vaginalis. When the result of injury, it is found with or without previously existing hydrocele. In the former it is caused by a blow or kick over the hydrocele, or by tapping, in which case a vessel may be punctured, or, the pressure being removed from the large vessels, hæmorrhage takes place into the sac; the blood may be absorbed under favourable conditions, but usually secondary changes take place in the walls and its contents. In the latter it is caused by a blow, a kick, the lifting a heavy weight, or by straining. The contents of a hæmatocele may be a red or chocolate-brown-coloured fluid, with or without clots; it is sometimes as thick as treacle. On opening an old, slowly formed hæmatocele a dark fluid will escape, when the walls will probably be covered by a soft, flocculent blood clot.

The walls of the hæmatocele vary in condition from many circumstances. The outer part of the wall is always thickened; internal to this usually is a layer, varying in thickness, of laminated, decolorised fibrin; within this, again, is a layer of softer laminated clot, and, most internally of all, recently coagulated blood. Sometimes the outer layer becomes hard, or subject to calcareous deposit. These laminated false membranes are derived from the blood which escapes into the tunica vaginalis becoming coagulated; in other cases it may result from inflammatory changes in the tunic, the plastic products forming the false membranes.

Signs and symptoms of hæmatocele. — Whether originating slowly or suddenly, hæmatocele of the tunica vaginalis presents a heavy, pyriform swelling in the scrotum, with its base downwards. The swelling is somewhat tense, and indistinctly fluctuating; the scrotum will be livid or ecchymosed, and the veins over it unusually prominent. The testicle occupies the lower and back part of the tumour.

There may be a good deal of pain at first, but this may wear off, to be succeeded by severe pain again should inflammatory mischief appear. As is to be expected, it is neither translucent nor resonant.

Diagnosis.—Hæmatocele has to be distinguished from hernia, hydrocele, orchitis, or other enlargements of the testicle, malignant or benign.

From hernia it is distinguished by inability of reduction, non-resonance, the history of having commenced below, the possibility of isolating the upper end of the hæmatocele from the abdominal ring, and by there being no impulse.

From hydrocele it is distinguished by being heavier, less fluctuating, non-translucent; and the history (whether there had been a blow sustained or not) may help a little.

As to malignant or other solid growth of the testicle, hæmatocele may be diagnosed therefrom by the history, size, form, weight, smoothness, or irregularity of surface, *e.g.* the swelling is globular in hæmatocele, oval in affections of the testicular substance; in malignant or cystic diseases the swelling is firmer, heavier, bossy, and irregular. The absence, or otherwise, of testicular sensation is an important element in diagnosis.

When there is doubt, as often happens, the diagnosis may be verified by puncturing, or, better still, by making an exploratory incision, with due antiseptic precautions.

Treatment. — This will vary according to the condition of the hæmatocele and that of the patient.

When the case is recent, the patient must be sent to bed, the scrotum supported on a pillow, and ice or evaporating lotions applied over the swelling, care being taken that the ice does not induce sloughing of the scrotum. If the swelling do not go down in a satisfactory manner, it may be tapped. In some cases where the coverings are thin, and the contents very fluid, the sac may be injected with iodine as in hydrocele.

If the hæmatocele does not subside, or threatens to suppurate, or the patient be very feeble, antiseptic incision into the sac will be the best treatment. Where the patient is old and much debilitated, the walls of the sac much thickened and calcified, and suppuration threatening, it is probably the safer treatment to proceed as follows: Make an opening into the front of the scrotum, about two inches in length, then carefully open the cavity of the hæmatocle, turn out the clot, wash it out with a solution of zinc chloride (1 to 40), introduce a drainage tube through the bottom of the opening, and put in one or two carbolised catgut sutures; finally, dress the wound with complete antiseptic dressings. If there be hæmorrhage from the inner wall of the cavity, stuff it with carbolised lint and apply pressure.

B. *Encysted hæmatocele* is a rare occurrence; it is due to effusion of blood into one of the spermatic cysts found in connection with the epididymis, or between the tunica vaginalis and tunica albuginea, as described under hydrocele. The treatment must be on the principles already laid down.

C. Intratesticular hæmatocele is of post-mortem interest only. Spurious forms exist with malignant disease.

DISEASES OF THE SPERMATIC CORD.

Independently of affections connected with arrest in development and non-closure of the processus vaginalis, the diseases to be dealt with are: hydrocele, hæmatocele, tumours, and varicocele.

1. **Hydrocele of the cord** occurs in a diffuse or encysted form.

Diffused hydrocele of the cord is a very rare affection; it consists in a sort of dropsy of the areolar spaces of the covering of the cord. The swelling produced is smooth in outline and cylindriform in shape. The testicle is found to be normal; the disease gives rise to no pain; firm pressure will cause its disappearance, but it returns immediately.

This disease might be taken for a hernia, unless the history of the case, the absence of impulse, and the obscure fluctuation be remembered. No treatment has proved satisfactory.

Encysted hydrocele of the cord is a collection of fluid in a distinct cyst, such a cyst being formed (1) in the imperfectly obliterated funicular process of the tunica vaginalis; (2) in an old hernial sac; or (3) in a cyst of new formation; the latter probably taking origin in the fœtal remains connected with the testicle, either the hydatid of Morgagni, the organ of Giraldes, or the vas aberrans.

The affection is most frequently met with in children. The walls and fluid are similar to those met with in hydrocele of the tunica vaginalis. Spermatozoa have been found in some of the cysts. The vas deferens and its accompanying vessels are behind the cyst.

Signs and symptoms.—A well-defined swelling, oval in shape and fluctuating in character, is usually easily made out. The growth is painless, freely movable, and somewhat slow in its development. The usual place of growth is near the external ring, but it may occur in any portion of the cord, between the internal ring and the testis (Fig. 42). The usual size is that of a pigeon's egg, but it may grow larger. Sometimes more than one is present, probably such condition being due to the irregular obliteration of the funicular process. On the other hand, the funicular portion may be patent in its whole extent to the testicle, being only closed above.

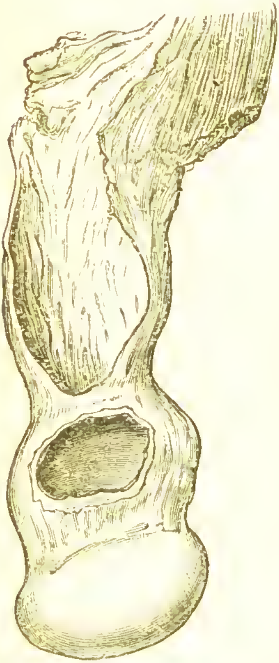

Fig. 42.—Encysted Hydrocele of the Cord. (Lond. Hosp. Museum.)

Diagnosis.—Hernia is the most likely condition to be mistaken for encysted hydrocele. However, when it is remembered that hernia has no transparency, no fluctuation, has a neck that cannot be isolated from the internal abdominal ring, and that a well-marked impulse is perceptible, whilst exactly the opposite obtains in hydrocele, there ought not to be much difficulty in diagnosis.

Treatment.—With children usually some evaporating lotion or painting with iodine will cure the disease. If not, it may be tapped, or acupuncture may be tried. In older patients, if simple treatment be not successful, injection of iodine may be tried. If more active treatment be needed, opening the hydrocele antiseptically should be practised.

Hæmatocele of the cord may occur in two forms, diffuse and encysted.

Diffuse hæmatocele of the cord is due to extravasation of blood into the loose connective tissue surrounding the cord; it is caused by rupture of either an artery or vein from straining.

The signs and symptoms are plain enough; a swelling suddenly occurs during a strain, which swelling is ill-defined and irregular, but following more or less closely the course of the cord. It is to be distinguished from an omental hernia by its being irreducible, ill-defined, and frequently associated with discoloration of the skin over the swelling.

Treatment.—Rest, ice, and evaporating lotions; should all other means fail, or suppuration threaten, free incision with antiseptic precautions.

Encysted hæmatocele of the cord is so rare that its discussion is useless. The only known example is No. 2,816 in St. Bartholomew's Museum.

Varicocele.—The pampiniform plexus of veins met with in the spermatic cord immediately above the testicle very frequently becomes varicose. It is the left side almost invariably which is first attacked, and, should both sides show signs of varicosity, the left usually precedes the right.

Etiology.—Although many reasons have been advanced to explain the origin of this affection, yet a certain amount of obscurity remains. The causes may be classed under two heads, general and local.

General or constitutional causes are feebleness of system, debility, a loss of tone, each and all inducing a relaxed condition of the tissues generally.

Local causes assigned are: Mechanical, such as the pendency of the testicle, the looseness of the cellular tissue surrounding the veins, and the peculiarly large plexus of vein involved. Functional causes are early and irregular excitation of the sexual organs.

As already stated, varicocele occurs much more frequently on the *left* side; the reasons for this are: (1) The lower position of the left testicle; (2) the longer course of the left spermatic vein, the right opening into the vena cava, and the left into the left renal; (3) the peculiarity of the valve at the opening of the left into the renal vein; (4) the difference in the current of the blood stream on the right and left side; thus, on the left it is at right angles to the spermatic vein, but on the right side it follows a parallel direction; (5) there is also a difference in the blood pressure, being less in the vena cava than in the left renal vein; (6) the left vein is further crossed by the sigmoid flexure, and consequently subject to the pressure of fæces in this portion of the bowel.

Signs and symptoms.—There is in the scrotum and extending up the cord a swelling very variable in extent in different cases. The swelling is irregular in shape and described as giving the sensation of a "bag of worms;" it may be seen to undergo changes with the respiratory movements, and exhibits a slight impulse on coughing. The skin of the scrotum is much thinned and the veins may be seen through it; the cremaster muscle is much wasted, but responds to irritation. The testicle lies at the bottom of the mass of veins, it is usually diminished in size and softer in consistence; probably in all cases there is a certain amount of atrophy; this must be clearly the case when interference with the nutrition of the part is considered, but probably complete atrophy hardly ever occurs from this cause alone. The swelling slowly diminishes in size when the patient assumes the recumbent position, to return on rising, even if the finger be kept firmly pressed upon the internal ring.

Usually the pain of varicocele is not marked, but there is a decided feeling of discomfort from dragging. When the varicocele comes on later in life there is often pain of a neuralgic character. In most cases there is more or less tenderness of the testicle.

This affection is often productive of great mental distress and anxiety, induced either by the habits of the patient or his fears of impotency.

Diagnosis.—Varicocele is, by a careless practitioner, now and again mistaken for hernia.

Treatment.—The general principles of treatment short of operation, are to restore tone to the system and calm to the mind. Dispel the dread of impotence, encourage exercise and the use of the shower bath and local sponging, correct constipation and treat the dyspeptic troubles. To still further support the veins than can be done by a suspensory bandage, a portion of the lower part of the scrotum may be drawn through a ring; Wormald's silver ring is the best.

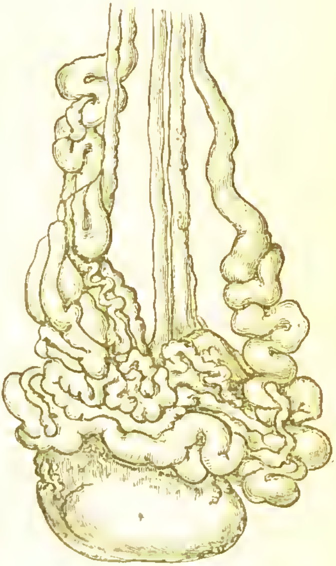

Fig. 43.—Varicocele.

The *operative* treatment has for its purpose the obliteration of the hypertrophied veins of the spermatic cord. This will be required when palliative treatment has failed to give any relief, the varicocele going on increasing in size, and threatening complete or nearly complete atrophy of the testicle. If this affection prevents a man entering any of the public services, or if the existence of varicocele in itself is having a pernicious influence upon the mental state of the individual, then operative interference to ensure radical cure is necessary.

Many different kinds of operation have been practised ; of these one of the following three will be found to answer all purposes. The most important danger to avoid is that of exciting septic thrombosis, as this may end in septicæmia or pyæmia. This is almost beyond the power of the surgeon to provide against; hence no operation should be forced on any patient by the surgeon, as repentance for the proffered advice may follow all too late.

Whatever plan of operation is followed, it is necessary to recognise and separate the vas deferens from the mass of veins.

(1) Mr. Erichsen's plan of operation is as follows: Make a small incision in the scrotum on either side of the offending mass of veins. A needle threaded with silver wire is passed in at one incision and out at the other, transfixing the tissues between the mass of veins and the vas deferens ; the needle is next returned between the veins and skin, so that only the veins are included in the loop of wire. The wire is then tightened by twisting, the twist being increased from day to day. Gradually, in eight or ten days, the wire ulcerates its way through the mass of veins. During the process the patient is kept in bed, and the part dressed with iodoform or wet boracic lint until healing is completed.

(2) Mr. Curling's operation consists in passing two hare-lip needles, one about one inch above the testicle, the other three-fourths of an inch higher up the cord, behind the vein, in front of the vas deferens. A piece of cardboard is placed beneath the pins, and a strong silk ligature, applied in a figure of 8 over the needles, is made to constrict the veins between

them and the skin. The veins are then divided subcutaneously between the two needles. The ligatures may be removed in about a week.

(3) Another mode of operation, and as good as any, is to make an incision in the scrotum about one inch long over the varicocele; carefully dissect down to the enlarged veins. These will probably project into the opening. A carbolised catgut ligature must be passed, and tied tightly around the veins at the upper part, and again at the lower part, and the ends cut short. The mass of veins between the two ligatures is then excised, a small drainage tube is placed in the wound, the edges of the wound brought together, and dressed with carbolic; the whole operation must be conducted antiseptically, and care taken not to injure the vas deferens. It should be remembered that in these cases some weeks must pass before the veins and their contents become absorbed, and that a suspensory bandage should be worn for many months after.

Tumours of the spermatic cord other than cysts are not common. Fatty tumours have been met with; malignant growths also which have extended from the testicle to the cord. Neither the pathology or treatment of such disease requires comment.

DISEASES OF THE SCROTUM.

Malformations of the scrotum are for the most part associated with hypospadias and epispadias; the cleft scrotum, occasionally met with, has given rise to the very vexed question of hermaphroditism. The plastic operations undertaken for such conditions other than hypospadias are merely of an empirical nature.

Injuries of the scrotum.—Considering the position and texture of the scrotum, wounds are more rare than might be expected. Incised wounds are to be washed clean and brought neatly together with Chinese silk sutures. Contused wounds are specially liable to become gangrenous; they are best treated by support to the scrotum, and ice or evaporating lotions rigorously applied. Should gangrene threaten, punctures or incisions will have to be made.

A specimen of hæmatocele occurring in the scrotal tissues is exhibited in the Hunterian Museum (No. 4292).

Œdema of the scrotum. — Children are especially liable to this disease. Newly born children now and again exhibit a form of œdema, and children of six months and thereabouts are apt to suffer from a similar swelling.

It quickly subsides under the effect of treatment, such as an evaporating lotion or dusting with oxide of zinc. In very weakly children care must be taken that the œdema do not end in erysipelas or sloughing.

In adults it is often the associate of general dropsy, or may be due to some affection of neighbouring parts, such as the urethra, etc. It is best relieved by numerous punctures.

Inflammation and erysipelas may result from slight injuries, abrasions, etc.; from a boil or small abscess; from sores and eruptions in other parts, such as the thighs, abdomen, etc.; from dribbling of urine, from simple incontinence or from a urinary fistula. Erysipelas may also occur idiopathically. Any one of these conditions may end in cellulitis or sloughing of the scrotum, especially as it is often a local expression of general disease or debility. Care must be taken not to mistake the disease for extravasation of urine.

The *treatment* must be carried out on general principles. Special attention must be paid to the condition of the patient. Iron and quinine, or cinchona and ammonia, must be given freely, and a liberal diet ordered; any specific affection having its special treatment. The local treatment will consist in warm fomentation, disinfecting and deodorising lotions where necessary; when there are indications of sloughing, free incisions must be made.

Gangrene of the scrotum may occur as the result of the above affections, in the course of fevers, or from extravasation of urine. For treatment, free incisions must be made, antiseptic and warm lotions or charcoal poultices applied. Great attention must be paid to the general health. To favour separation of the dead parts stimulating applications may be needed. Both testicles and cords, although exposed, will probably get covered in during the healing process; if not, some plastic operation will be required.

Eczema of the scrotum is not uncommon in elderly and gouty people, and must be treated on general principles.

Prurigo of the scrotum is confounded with three other conditions, viz. eczema, pruritis, and phthiriasis (crabs). True prurigo is a most obstinate affection, mostly occurring in elderly people, and is most obstinate and troublesome. With children or young people it soon disappears under judicious treatment. The affection is characterised by the presence of red flat papules, the skin being thickened and more moist than normal, there being a decrease in the horny epithelial cells. The causes are obscure, for sometimes it appears to occur in perfectly healthy people. It is probably due to some change in the nerve endings, or in the structures around them.

The *treatment* must be to support the general health, and counteract the baneful influence of the local irritation. Locally, alkaline lotions, boracic and carbolic acid lotions, and a host of others have been tried, but frequently the disease proves intractable. White precipitate ointment will cure the phthiriasis, and pruritis is relieved by the bichloride of mercury, and dilute hydrocyanic acid, gr.ij and ʒij respectively, to six ounces of water.

Elephantiasis.—This, a very common disease in eastern countries, is rarely met with in Europe. The cases seen in England are undoubtedly importations.

Signs and symptoms.—The scrotum and penis are enormously enlarged, sometimes weighing more than one hundred pounds. The skin is hypertrophied, brawny, rough, and covered with verrucosities, or mammillated. On microscopic examination the cellular elements of the skin and subcutaneous tissue are found enlarged and increased in number, some undergoing degenerative changes. There is also a large increase in the fibrous tissue, this being arranged in layers parallel to the surface. The papillæ are much enlarged, and amongst the tissues there is a large amount of albuminous and fibrinous exudation. The lymphatic vessels and spaces are much enlarged and filled with cells and fibrinous material. Another affection, probably a variety of this disease, is the so-called *lymph scrotum.* In it the scrotum also enlarges, a milky or sero-sanguinolent fluid oozes from the skin; associated with which there is at times slight feverishness, chylous urine, enlargement of lymphatic glands, and great increase of the lymphoid tissue in the scrotum.

Each of the affections mentioned is believed to be due to the presence of "filaria sanguinis hominis" in the blood.

Treatment.—If seen in the early stage it may be thought wise to try the effect of mercurial ointment, combined with pressure of a rubber bandage. Probably, the only remedy is complete excision of the growth, a formidable operation not to be undertaken rashly.

The testicles and penis should be saved if possible. Care must be taken that there be no hernia, and that the cavity of the tunica vaginalis be not opened.

The patient should be placed upon the operation table a few hours before the time for operation; the mass to be removed should be elevated by suitable tackle, bound with elastic bandages, and in some such way all the blood possible should be got out of it. Then the base may be clamped, constricted by an elastic cord, or several bands may be passed through and around different portions of the base. Then, the patient being under an anæsthetic, three skin flaps, one central and two lateral, must be dissected out of the healthy skin, to cover the penis and testicles. Next the penis and testicles should be dissected out, the glans being found by following up the opening by which the urine escapes. After these have been turned up to the abdomen, the whole mass should be removed. Great dexterity is needed to secure the blood-vessels; otherwise the patient may die from loss of blood.

Cancer of the scrotum.—Epithelioma is the variety of malignant disease usually met with in the skin of the scrotum. So exclusively almost is this disease met with amongst chimney-sweeps that it has obtained the name of "chimney-sweeps' cancer."

The growth commences as a soft wart, tubercle, mole, or enlarged sebaceous gland, generally in the front part of the scrotum. After a time this becomes hard and indurated, spreading concomitantly; next a scab forms, which falls off, and a small bleeding ulcer is found beneath. The ulcer goes on spreading at its margins, always being preceded by induration. Thus a sore, discharging a bloody, ichorous, foul liquid, having a hardened base, irregular, excavated, and thickened, with a tuberous and hardened margin, is formed. This goes on spreading until the whole scrotum is destroyed, and the testicles are exposed. The inguinal glands are infected, and after a time break down and ulcerate; but rarely, if ever, are the lumbar glands or internal organs involved. It usually destroys life by the wasting induced by the discharge.

The *diagnosis* is not usually difficult; the age of the patient (rarely occurring before thirty, most frequent about middle life), his occupation, the slow ulceration always preceded by induration, together with the history, will mostly point to the true nature of the case.

The *treatment* consists in the complete removal of the growth; this may be done by caustics, but the knife is the most satisfactory method. Care must be taken to go wide of the diseased part. Should the affection recur, it should be again removed. The inguinal glands should be removed if enlarged, most certainly if they be indurated. If the disease has advanced to a large extent, and if the inguinal glands have ulcerated, all one can do is to feed, tranquillise, and soothe the patient. The fœtor may be moderated by deodorants.

Other growths of the scrotum are: (1) fatty, (2) fibrous, (3) multiple sebaceous tumours, (4) cysts. Other growths, occurring in cicatrices of the scrotum, have been described, viz. carcinoma and sarcoma, cartilaginous and adenoid tumours. These need no special remark.

DISEASES OF THE TESTICLE.

Inflammation of the testicle is a generic term used to include inflammation of two associated organs, the epididymis and the testicle itself. Of these epididymitis is by far the most common, acute orchitis being a rather rare affection.

Epididymitis.—Acute inflammation of the epididymis is almost invariably a secondary affection, being set up by gonorrhœa, prostatic irritation, or by the passage of a catheter. It may, however, occur primarily, as when a pendulous scrotum, during a long walk, allows of the epididymis being compressed and irritated by the clothing.

Etiology.—The explanation of how disease, or irritation, of the urethra sets up epididymitis bears discussion. (1) Continuity of inflammation, *i.e.* extension of the inflammation from the urethra along the common ejaculatory ducts, and so along the vas deferens to the epididymis, is an accepted explanation by some. Were this the case, one would expect to find the vas deferens in the groin swollen and tender, and not only so, but also the vesiculæ seminales behind the prostate in the same condition. That this actually does take place I have satisfied myself by frequent examinations, per rectum, of the vesiculæ seminales, immediately after an epididymitis shows itself. In most cases (six out of nine) one vesicula seminalis was found swollen and tender, the vas deferens at the same time being found tender in the groin. I have come to the conclusion that continuity of inflammation is the commonest cause of epididymitis, but that, unless the swollen seminal vesicle is felt for within twelve hours after the onset of epididymitis, all trace of this symptom disappears.

(2) Reflex irritation is possibly a correct explanation in many cases. When continuity of inflammation, as explained, does not, or is denied to, take place, then one falls back upon reflex irritation as an explanation. The point of the penis and the testicle are connected in the spinal cord with the same centre. An irritation or inflammation, existing in any part of the area supplied by that centre, may extend to the whole of the area which the nerve centre influences. This is advanced as an explanation and bears some weight of truth. (3) Metastasis is the explanation

advanced by those who regard the condition as a mystery.

All attempts at explaining why epididymitis supervenes in any particular case are futile, as men who take the utmost care may get epididymitis, whilst those who are careless as to their clap and take no treatment for it may escape. It may come on late or early in the disease. Injections into the urethra seem to have a tendency to set it up. Particular drugs are blamed by some, but there is no rule to go by. Certain it is, however, that a man who uses strong urethral injection in the early stage of clap, and who takes much walking exercise, is very apt to develop epididymitis.

Signs and symptoms.—The patient is made aware of the onset by an uncomfortable sensation in the region of the scrotum, which induces him to alter his position frequently and by-and-by to feel and look at his testicle. He will find that the testicle of that side appears swollen, with pain along its posterior part, and slight tenderness in the groin. In a few hours the pain becomes acute, the swelling rapidly increases, and the symptoms of feverishness supervene of a more or less acute nature. When fully developed the skin of the scrotum of the inflamed part appears tense and glistening, the furrows and wrinkles of the scrotum disappear, there is much dragging sensation in the groin and iliac fossa, and an aching pain in the lumbar region.

Diagnosis.—Epididymitis is to be distinguished from orchitis, which it closely resembles. This close resemblance is brought about by the effusion into the tunica vaginalis, which occurs in both diseases. The epididymis touches the tunica vaginalis for some distance along the outer side behind; hence an inflammation of the former will set up an effusion into the cavity of the latter. This effusion is modelled in the tunica vaginalis to the surface of the testis, and leads to the appearance of the testis itself being inflamed. That this is not the case may be made out by careful examination of the epididymis, which will be found above and behind the testicle, lying like a thick semilunar mass, threatening to overlap the testicle above, below, and at the sides. The swelling of the testicle will be found to be apparent only from the fact of fluctuation being present, from the slighter constitutional and local symptoms generally; and, if transparency of the fluid can be made out, as in hydrocele, then it will be conclusively proved that an acute hydrocele, and not an orchitis, is present.

Prognosis.—In a healthy man the prognosis is complete recovery. In weakly men, or in the strumous, there is the danger of testicular disease developing. Now and again abscess may result; thickening of the epididymis may remain; obstruction of the lumen of the tube may cause subsequent wasting of the testicle. Occasionally epididymitis is succeeded by orchitis.

Treatment.—*See* Orchitis (page 478).

Orchitis.—Acute inflammation of the body of the testicle is a less common disease than inflammation of the epididymis.

Etiology.—The commonest causes of simple orchitis are: a blow on the testicle, extension of the inflammation from the epididymis, metastasis, so called, from mumps, and the gouty diathesis. That orchitis may arise primarily from gonorrhœa, without epididymitis, we have on high authority, but it is seldom met with in practice.

Signs and symptoms.—In the onset and subsequent exhibitions of the disease simple orchitis closely resembles epididymis. It will, however, be noticed, that the constitutional disturbance is greater, the local pain is much more intense; the patient does not care to assume the erect position, but walks bent with his legs apart. The testicle is felt to be enlarged, globular, and extremely sensitive and tender; the scrotum is seen to be red and swollen. Effusion into the tunica vaginalis also occurs in this as in epididymitis, as can be ascertained by making out the fluctuation.

Diagnosis.—Acute orchitis has to be distinguished only from epididymitis. The diagnosis has been already given with epididymitis (*q.v.*); that mumps is a concomitant disease, can be made out by examination of the salivary glands; one submaxillary, slightly enlarged, may be all that is to be found.

Prognosis.—Orchitis usually gets well, but it may, rarely, end in suppuration or chronic enlargement, or it may be followed by some of the diathetic diseases, mentioned anon. Should suppuration occur, the gland tissue may escape through the opening in the tunica albuginea, and present through the skin as a hernia testis. (*See* Tubercular Disease of Testis).

Treatment.—The treatment of epididymitis and orchitis will be considered together, although the surgeon is much more frequently called upon to treat the former. If absolute rest can be obtained, lay the patient up in bed at once. If the disease is epididymitis, the patient might be able to go about his work, with the scrotum well tucked up in a comfortable suspender, but in orchitis he will be compelled to lie up. When in bed, the scrotum is to be supported upon a pillow, placed edgewise between the thighs; a pillow below the hips, also, will tilt the pelvis and afford comfort. Administer a smart purgative. Apply hot fomentations to the supported scrotum, to be changed every half-hour. Place a cradle over the patient's pelvis (a bonnet-box will serve the purpose, when nothing else is available). Should further treatment be required, proceed as follows: To allay pain, apply belladonna externally over the scrotum and along the groin. A suppository of $\frac{1}{2}$ gr. of ext. opii, and of ext. belladonnæ respectively, introduced in the rectum at intervals of four or six hours, will aid in soothing pain. The application of simple or poppy-head fomentations. Local depletion, not by leeches, to the scrotum (or extravasation, to a frightful extent, may result), but by pricking a vein, may be productive of good. When about to deplete, proceed thus: Cause the veins of the scrotum to dilate by heat, either hot fomentations, or by the heat of the fire, the patient sitting in front thereof. Compress the distended vein by the thumb above the spot to be punctured, and incise with a lancet or scalpel, freely, to prevent blood escaping beneath the skin of the scrotum. Should the pain become great, opium must be given in large doses; or the cavity of the tunica vaginalis must be punctured; or a needle or narrow scalpel may be driven through the tunica albuginea into the testicle, and so punctured or incised; multiple punctures with a needle, rapidly made is the most efficacious and least painful method of puncturing the tunica vaginalis. Instead of hot applications, cold applied to the scrotum in the form of cold-water drip, evaporating lotions, or an ice bag, may cut short inflammation.

Subacute orchitis, as occurs in gouty people, and as concomitant with mumps, requires but to be mentioned. The pain in gouty inflammation of the testicle far exceeds what the local condition of things would lead one to expect. When concomitant with mumps the inflammation may become acute, and give rise to subsequent abscess or atrophy. The usual local remedies are to be applied; in gouty orchitis vinum colchici acts almost as a specific.

Simple chronic orchitis, sometimes called simple sarcocele, to distinguish it from orchitis dependent upon the syphilitic or tubercular taint, is merely an induration of the testicular connective tissue, usually the result of acute inflammation. At times an epididymitis will end in chronic enlargement of the testicle. A blow or squeeze is a frequently assigned cause of this, a rather infrequent primary disease.

The *pathology* of such a condition is shortly told. The effusion of inflammatory materials causes a hyperplasia of the connective tissue, which, becoming developed, expands the bulk of the testicle, at the same time compressing the vessels and the tubuli seminiferi within its grasp. An untoward end of this may be loss of testicular sensation, indicating that the tubuli seminiferi are obliterated, and should this take place in both testicles, as sometimes happens, sterility must result.

Signs and symptoms of the disease are: an enlargement remaining after an acute attack, accompanied by less and less pain as time wears on. The testicle feels smooth, enlarged, hard, and is devoid of testicular sensation. There is but a slight fluid effusion into the tunica vaginalis, and the testicle appears flattened at the side. The epididymis may or may not be slightly enlarged.

Diagnosis.—The history of a previous acute inflammation or of a blow or squeeze, the chronicity, the absence of syphilitic history, the non-implication of the epididymis, and the smoothness of the surface of the testicle, will decide between simple and syphilitic, tubercular and malignant sarcocele. The disease more usually affects youths, and that, combined with the fact that both organs are affected usually either separately or together, will distinguish it from the fibro-cystic disease of older men. The shape, history, and non-transparency will establish the diagnosis between it and hydrocele, and its gradual development, contrasted with the sudden onset of a hæmatocele, will decide the diagnosis between these disorders.

Prognosis.—If treated in time, a healthy normal condition may be obtained; but if the testicular sensation has disappeared on even deep-seated and decided pressure, then will sterility be the result; and all attempts at promoting absorption are then too late to save the secreting tissue.

Treatment.—Strapping presents the chief and almost the only hope of cure. To strap a testicle proceed as follows: Clip the hairs of the scrotum and wash the part clean. When it is carefully dried stand the patient up against a wall, with his head and heels touching the walls, and his feet well separated. The surgeon, sitting in front of the patient, grasps the scrotum above the enlarged testicle between the finger and thumb. With plain diachylon plaister, or with emplastrum hydrargyri or lead plaister, pass an encirclement firmly around one side of the scrotum above the offending testicle. This strap may be made to encircle the scrotum twice or thrice, and made so tight that the testicle is compressed against the lower part of the scrotum. With this as a fixed point, strips of plaister, two-thirds of an inch wide, are made to pass alternately from behind forwards and around the testicle until the whole is covered. On the third day the plaister will require renewal.

Syphilitic disease of the testicle.—If it be true that the tertiary stage of syphilis is characterised by a hyperplasia of the connective tissue of organs, then is syphilitic disease of the testicle a disease of the tertiary stage. The expression of the disease is in one or other of two methods, diffuse thickening of the connective tissue, or localised induration leading to gumma of the organ. If diffuse, the organ is symmetrically enlarged at first, to become nodular afterwards, either from unequal contraction or the presence of gummata (Fig. 44).

Signs and symptoms.—The body of the testicle itself is the seat of the disease, and often both organs are affected, either together or consecutively. At first the testicle is felt to be smooth and globular, but it soon becomes nodular. The stony hardness of the enlargement, the absence of pain, the obscurity of the testicular sensation on pressure, the gradual development, the chronicity of the affection, and the preservation of the generally ovoidal outline of the tumour, are all characteristic of the disease. The presence of fluid in the tunica vaginalis obscures the disease, and it may rarely accumulate in such quantity that the primary cause is overlooked. Occasionally loose indurated bodies are met with in the fluid effused.

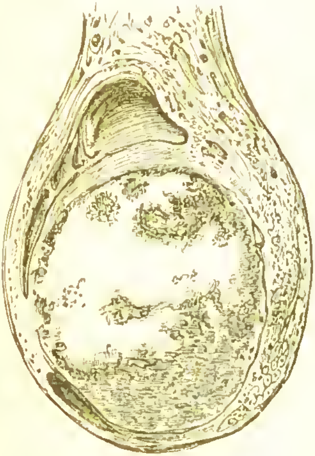

Fig. 44.—Syphilitic Disease of the Testicle. (Lond. Hosp. Mus.)

Diagnosis.—The history of syphilis, the stony hardness of the testicle, the nodulation of the surface, the absence of pain, and the speedy obscurity of the testicular sensation, are all so distinct that but little practical clinical difficulty is experienced in attaining a sure diagnosis. Only when hydrocele is present will there be any difficulty.

Prognosis.—If submitted to treatment before the disease has lasted a month, a good prognosis may be given. If, however, the disease is of some months' standing, it may be doubtful whether or not a complete cure will be effected. The disease may lead to obliteration of all the secreting parts of the gland, suppuration, or the breaking down of a gumma which has become adherent to the skin; subsequently hernia testis or atrophy of the testicle may ensue.

Treatment.—The local treatment is to be as that recommended for simple orchitis, strapping, or strapping with either Scott's dressing or simple mercury plaister, will be the most effective; soap plaister will, however, often act as well.

When hydrocele is pronounced it may be wise to tap the fluid, so that strapping may have a more decidedly direct effect on the testicular substance.

The constitutional treatment is that for syphilis generally.

Tubercular disease of the testicle.—Under this name are included tubercular epididymitis, tubercular orchitis, acute miliary infiltration of the testicle, and the more slowly developing tubercular disease dependent upon strumous deposit.

The history of a patient presenting himself with a tubercular disease in the epididymis, for it is there the disease most frequently begins, is, that by chance, or from some accidental uncomfortable sensation, he placed his hand upon the testicle and there discovered a small lump, which up to that time had given rise to no inconvenience; that since then the lump had got gradually larger, and of late some shooting, darting pains now and again startled him; but that, until the skin began to look inflamed, he did not think it worth bothering about. On inquiring into the family history it may be found that his brothers have had enlarged cervical glands, or tubercular disease of the testicles or lungs; that some of them had died young of intestinal disorders; that his sisters are affected, one with spinal curvature, another with disease of tarsal bones, and so on. The patient may be tall, active, and muscular, fond of athletics and proficient at them.

Signs and symptoms.—The first appearance of the disease has been already mentioned as an indolent lump in the epididymis, but before it comes under the surgeon's notice it is usually more advanced, and it may be only when suppuration threatens that the patient presents himself. The lump usually softens, becomes incorporated with the skin, fluctuation and inflammation occur, and the surgeon is usually called upon to open the abscess, when a small quantity of curdy pus may be evacuated. With poulticing, or hot boracic lint dressings, the inflammation and suppuration may subside and the part heal. Some time, say six months, afterwards the same condition of things is gone through again, the surgeon being called upon to evacuate another abscess. During the healing process, if not before, the patient may complain that there is a dragging sensation in the groin, which proves, on examination, to be a thickened vas deferens; on the other hand, examination of the testicle itself may elicit the fact that its smoothness is lost, and that it has become nodulated and uneven. Towards either one or other, or both of these directions, viz. towards the vas deferens or testicle, the disease travels.

When the disease extends towards the vas deferens, the fact is recognised by a thickening of its walls and an induration of its substance. After a time the affection of the vas deferens may have extended so far that its tortuous ending, and the vesicula seminalis associated with its ending, may be felt to be indurated and enlarged by rectal digital examination. Purulent deposit may next appear in the urine, to be speedily followed by tubercular disease of the kidney or by lung mischief.

When the disease extends towards the testicle, that gland becomes uneven, enlarged, manifesting but little pain, and retaining the testicular sensation on digital pressure. One or both organs may be attacked consecutively or together. Hydrocele is but a rare, very rare, concomitant. By-and-by an indurated spot on the testicle becomes adherent to the skin, and then softening and suppuration result, necessitating, it may be, opening by the knife. A curdy pus exudes and the discharge may cease, a sinus following, with occasional inflammatory effusion and obstruction occurring therein. Lastly, the testicle may atrophy and wither away, or the gland substance may extrude through the skin opening, and a fungus testis, hernia testis, or benign fungus of the testis results.

Hernia testis is most frequently a result of tubercular disease, but it may come from the breaking down of syphilitic gummata, from suppuration following orchitis or chronic orchitis, and from wounds of the scrotum. The protruding mass may consist of the whole or part of the testicular substance, which protrudes as a mushroom-shaped mass, pedunculated, and overlapping the edges of the skin aperture. In its centre is usually a suppurating sinus; around the skin aperture the edge may be free or attached. The protruded tissue is usually of a greyish pink granulation tissue, or it may be covered by ordinary granulations with pus dripping from its surface.

Pathology.—It is consistent with the general behaviour of strumous and tubercular disease that the lymphatics of any part first show signs of change. Hence it is, therefore, to the lymphatics surrounding the vessels that one directs one's attention to the genesis of the local development of the disease. An accumulation of low-formed cellular matter distends the neighbouring tissues, presses upon the vessels, and, advancing by irritation and inflammation towards the surface, soon involves the skin. The neighbouring lymphatics become affected, catarrh of the vas deferens results, and scattered patches of cheesy deposits develop in the testicle, by-and-by to run together to form a cheesy mass (Fig. 45). A section of the testis examined microscopically will show the tubuli to be filled with a catarrhal epithelium, and the tissue of the testis infiltrated with giant cells. Now and again the testicle is found infiltrated with miliary tubercles.

The *diagnosis* of tubercular testis is not difficult: the age of the patient, usually young adult life; the gradually developing growth, its indolent character, the absence of hydrocele, the fact of the epididymis being first attacked, the softening and breaking down of the indurations, the thickening of the vas deferens, and the strumous or tubercular history, when taken together are sufficient to establish the diagnosis.

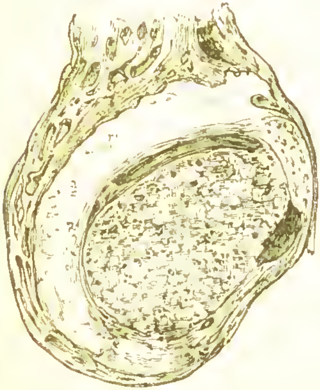
Fig. 45.—Tubercular Disease of the Testicle. (Lond. Hosp. Mus.)

The *prognosis* of tubercular disease of the testis is bad in the extreme. There is a great tendency to set up tubercular disease in either the lungs or the kidney. Unless very favourable conditions can be obtained the prognosis is almost as bad as possible.

Treatment.—The treatment of this disease will depend upon the stage to which it has progressed. If in the early stage, abscesses must be opened when necessary, and the usual local remedies must be applied, as in other similar inflammatory states. The constitutional treatment will be that for strumous diathesis generally. Should hernia testis occur, it requires special surgical treatment. An attempt may be made to bring the edges together by strapping, and to reduce the swelling by pressure and the application of the red oxide of mercury ointment. Should the ointment not succeed, the red oxide of mercury in powder dusted upon the part may effect absorption.

Failing these plans of cure, the edges of the opening in the skin may be pared, the tumour reduced, and the edges stitched together. Should an exuberance of granulations cover the true testicular tissue, they may be first shaved off and the edges brought together as before.

The question of castration in hernia testis has excited a great deal of discussion for many years, and the question is not now settled. The majority of practitioners condemn its removal, whilst, on the other hand, many testicles have been removed with apparently good results. The difference in results may depend more on the nature of the disease than the wisdom or skill of the surgeon. When the testicle is infiltrated with miliary tubercles it is almost certain an untoward result will follow castration; when, however, the testicular protrusion is the result of simply local strumous disease, castration need not necessarily be followed by a development of tubercle in other organs. The constitutional treatment is that laid down for strumous disease generally; but the only real hope of any good result is to get the patient sent to a dry warm climate with all possible speed. Egypt is, perhaps of all others, the best, and, if it suits the patient, he ought to stay there.

Fibro-cystic enchondroma of the testicle.—The synonyms for this disease, fibrous, fibro-cystic, cystic, fibro-cystic enchondroma, adenoid growth, fibroplastic growth, all indicate that opinions differ as regards the nature of the disease.

The *etiology* is unknown, further than that it is a disease which belongs to older men, and that it is, according to Curling, an affection of the ducts of the testicle (Fig. 46).

Signs and symptoms.—The history is that of gradual enlargement which had attained a good size before the patient noticed it; that there was no pain in the testicle to usher in the disease, no distinct history of a blow or squeeze which could have started it. Testicular sensation speedily disappears, hydrocele is absent, and the testicle may be felt to be firm, elastic, smooth, and communicating a springy resilient touch. The disease is always single, unattended by local or constitutional complications, either of an inflammatory or infective nature; and, when a grooved needle or trocar is thrust into it a sero-sanguineous fluid, more or less of a mucoid or sticky nature, may be withdrawn.

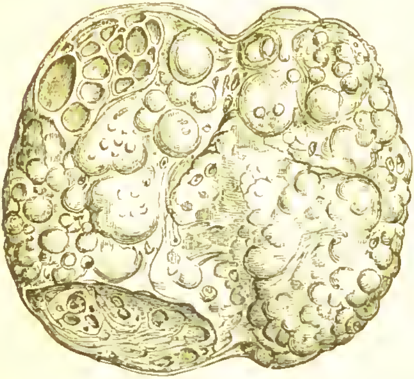

Fig. 46.—Cystic Disease of the Testicle. (Lond. Hosp. Mus.)

Diagnosis.—Absence of pain, translucency, true fluctuation, etc., are all negative signs and symptoms of a diagnostic nature. The age of the patient, the history of the development of the disease, the smoothness of the surface of the tumour, and many other negative and positive conditions detailed above, leave little doubt as to the nature of the disease.

Prognosis.—If the prognosis of castration for simple disease of the testicle is good, then is the prognosis of cystic disease of the testicle good, for castration is the only treatment.

Treatment.—(*See* Castration.)

Malignant disease of the testicle.—Both sarcoma and carcinoma are met with in the testicle, the former in much the greater proportion of cases.

Sarcoma of the testicle is usually of the small round-celled variety; but, when the disease is very decidedly cystic, the sarcomatous tissue is more usually of the large, spindle-celled variety.

Intermingled with the connective tissue of the gland are enchondromatous deposits, either naked-eye or microscopic, and not unfrequently a myxomatous condition is present.

Carcinoma of the testicle is of the encephaloid variety, and, but for its occurring in older people, and its being less frequently cystic, it is impossible to distinguish it from sarcoma.

The history of a case of carcinoma is that of a tumour appearing at, or about, middle life and growing rapidly.

The signs and symptoms.—The surgeon usually finds the testicle in encephaloid disease to be large, globular, smooth, firm, tense, and non-translucent.

As the case is watched, it will be found to become irregular, lumpy, softened at parts; the testicular sensation disappearing. Should the disease be allowed to run riot, the skin becomes involved, the glands on the groin, and especially the iliac glands, enlarge; the tumour then protrudes at the scrotum as a fungous mass (the fungus hæmatoides), and the patient succumbs to exhaustion.

The *diagnosis* between encephaloid and sarcomatous is well nigh impossible, except that the former belongs to elderly men, the latter to children or young adults. The history of the case will distinguish it from syphilitic or tubercular disease. The rapidity of growth is the only reliable diagnostic feature between it and simple fibro-cystic disease.

Castration is the only treatment for malignant disease of the testis.

Castration. — Removal of the testicle is required:

(1) For malignant disease, whether sarcoma or encephaloid.

(2) For cystic tumours, whether fibro-cystic or fibro-cystic enchondroma.

(3) When after acute tubercular disease the testicle becomes reduced to a fibrous mass or to a nodule, which keeps up irritation and suppuration.

(4) When hernia testis, from whatever cause, is intractable to other means of cure.

The proper time for its performance will depend on the nature of the case; thus, in malignant disease as early as possible; in tubercular disease as late as possible (or very early); in cystic disease as soon as the disease is diagnosed; and in hernia testis when all other means of cure fail.

Operation.—Place the patient on a table in a good light; administer an anæsthetic; shave the pubes, if it has not been done; bring the patient's buttocks to the edge of the table, with the lower limbs separated and secured to the legs of the table; place a basin or saw-dust trough on the floor to catch the blood. The surgeon now takes his stand between the separated thighs, and his first assistant on the right or left of the patient according to whichever testicle is to be operated on. If the tumour is very large, an Esmarch's cord, passed round the root of the scrotum, tightly crossed and carried round the body and secured, will serve to arrest hæmorrhage. Should such not be required, the surgeon grasps the tumour at once in the left hand, making tense the skin in front; then, entering the knife just below the external abdominal ring, he cuts downwards, to opposite the lower end of the tumour, either by a straight incision, or, if the skin be involved, by an elliptical incision, embracing the diseased portion. By a few cuts the cord is laid bare, seized between the finger and thumb, and isolated. Then it is to be dealt with by one or other of the following methods:

When the disease is that of malignancy, the cord is to be pulled well down, and a whip-cord ligature passed round the tissue of the cord *en masse.*

When the disease is tubercular, it is best to separate the vas deferens from the other tissues of the cord, pull it well down, and tie it; the blood-vessels are to be tied subsequently.

A clamp may be used to prevent retraction of the cord, until the vessels have been all secured.

Whichever method is followed, the testicle is then to be removed from its connections, the cord cut through a quarter of an inch below the clamp or ligature. All bleeding is to be stopped, both from the vessels of the cord (spermatic artery, to vas deferens, and cremasteric), and those of the scrotum the superficial and deep external pudic, and perineal arteries). A drainage tube is to be inserted, and the margins of the wound should be brought together by horse-hair or silver wire.

Atrophy of the testicle.—Varicocele, of all diseases, is most liable to develop a partial atrophy of the testicle. A complete atrophy of the testicular tissue occurs in chronic orchitis, when the fibrous induration and thickening leads to obliteration of the tubuli seminiferi. Lesions of the spinal cord, injuries to the head, deficiency in the blood supply from obstruction to the spermatic artery owing to the pressure of aneurismal or other tumours, lead to gradual atrophy of the gland. Early, excessive, and unnatural venereal excitement, has been followed by atrophy.

Hypertrophy of the testicle is occasionally found, when, owing to atrophy of a retained testis, the other in the scrotum becomes enlarged.

FUNCTIONAL DISEASES OF THE TESTICLE.

Sterility means inability to procreate. In the male it is associated with:

(1) Non-descent of the testicle, or some other malposition of the same. When one testicle is down, and well developed, that man, provided no other reason for sterility exists, is to be considered to be capable of begetting children. A malposition of the testicle means that that organ is functionless, as regards the production of spermatozoa.

(2) The ducts of the testicle may be obstructed from chronic orchitis, tubercular orchitis, the result of epididymitis. The latter is, when present on both sides, a common cause of sterility.

(3) Stricture of the urethra, by causing the semen to regurgitate into the bladder. It is a condition which admits of cure.

(4) What is called "aspermatismus" includes all mental and physical conditions, whereby coition is rendered incomplete.

The *treatment* for any one of these conditions will resolve itself into removing the cause, if possible, such as curing the urethral stricture, dispelling the inflammatory thickening left after epididymitis, and so forth.

Impotence.—The want of sexual desire may be temporary or permanent. Temporary, when it arises from over-study, excessive sexual indulgence, or from exhausting physical exertion, as in over-training and the like. Permanent, when desire is congenitally absent, or when it prematurely disappears. Idiots and imbeciles are also regarded as incurably impotent.

The *treatment* of temporary impotence is the restoration of a healthy tone to the body generally, and to the sexual organs in particular.

Spermatorrhœa is a real or apparent discharge of semen, escaping without sexual excitement. When spermatozoa are present, the disease is stigmatised as true spermatorrhœa; when they are absent, prostatorrhœa or false spermatorrhœa.

The *etiology* of the disease is undoubtedly a local irritation caused by masturbation or some disorder of the genitals. On the other hand, disorders of the intestinal tract, whether from constipation, worms, or the like, are frequently associated with spermatorrhœa. Some of these may be the cause, others the effect, of the disorder.

The *symptoms* are nocturnal emissions, becoming more and more frequent, it may be one or two every night; by-and-by, during walking, or especially driving, the seminal flow occurs. All this worries the patient into sleeplessness, nervousness, and he becomes mentally and physically a temporary wreck.

The *treatment* for such a condition is to remove local irritation, if any such exists; to improve the bodily tone, and to administer to his mind what comfort and advice lies legitimately within the province of the practitioner.

LEEDS & WEST-RIDING
MEDICO-CHIRURGICAL SOCIETY

XII. INJURIES AND SURGICAL DISEASES OF THE KIDNEY.

HENRY MORRIS.

ABNORMALITIES OF POSITION AND CONFORMATION.

THESE may be grouped as (1) simple misplacements, (2) movable kidney, and (3) floating kidney.

Simple misplacements.—In these the kidney may be higher or lower, nearer to or farther from the spine than usual, or may have its axes and borders altered in any direction, or may be turned over upon its anterior surface but yet thoroughly fixed in its position.

Among the congenital misplacements the most frequent is that known as the *horse-shoe kidney*. This variety consists in fusion of the kidneys at their lower ends by means of a thick mass of renal tissue, a transverse curve being thus formed with its convexity almost invariably directed downwards, and over the front of which the ureters descend. The joined kidneys are lower down, and much nearer the spinal column than normal. Horse-shoe kidney has been found in 9 out of 14,318 subjects examined.

In another set of congenital cases the kidney (usually the left) is placed over the sacro-iliac synchondrosis or the sacral promontory. Such malpositions in the case of women may cause dysmenorrhœa and even serious obstruction to parturition.

Acquired misplacements are met with as the results of pressure or traction of tumours or surrounding organs.

It is quite exceptional for simple misplacement to need any *treatment*, but where it causes suffering to such an extent as to demand surgical interference, and cannot be fixed in such a position as not to cause pain, nephrectomy is the only available resource.

Movable kidney.—The kidney, though more or less freely mobile, is excluded from the cavity of the peritoneum, occupying a position between that membrane in front and the muscular parietes behind.

In the majority of cases the degree of mobility is but slight ; occasionally, however, the peritoneum may be sufficiently loose to allow the kidney moving behind it, to descend below the pelvic brim, or to pass as far forwards as the anterior abdominal parietes, or across to the opposite side of the spine.

Symptoms.—The subjective symptoms are a sensation of dragging and weight in the loin, severe paroxysms of pain resembling nephritic colic, a sense of something moving within the abdomen, vomiting more or less severe, flatulence, and other indications of intestinal disturbance. The symptoms are aggravated by exertion, and relieved by rest in the recumbent posture. The urine is healthy.

The physical signs, if any exist, are the presence of a more or less movable tumour of renal contour, which, on palpation, occasions pain or a peculiar sickening sensation. Occasionally there is no recess in the loin to indicate the place vacated by the kidney, although percussion of this part elicits more or less resonance. The respiratory movements as well as the position of the body influence the position of the kidney.

Diagnosis.—Tumours of the omentum or mesentery have been mistaken for movable kidney, as have also a distended gall bladder, enlargement of the head of the pancreas, and a small ovarian tumour.

Treatment.—In many cases the symptoms are so trivial as to require no treatment. If only noticed after riding, dancing, or long standing, such exertion must be avoided.

A specially fitted pad and belt should be worn to retain the kidney *in situ*, should the mobility of the organ be the cause of continual pain and distress. Symptoms of congestion require absolute rest, hot fomentations, and anodynes. An operation is indicated when the symptoms are severe, unrelieved by rest or mechanical appliances, and occur in persons whose circumstances or temperament prevent the adoption of palliative measures.

Nephrorraphy is the preferable operation when the movable organ is sound, when both kidneys are movable, or when the non-movable kidney is diseased.

Lumbar nephrectomy is indicated when the movable kidney is diseased, providing the other kidney is sound.

Floating kidney.—This term designates that condition in which the peritoneum, owing to its congenital disposition, so completely envelops the kidney as to form a meso-nephron, and thus allow the organ to be moved in almost any direction.

Floating kidney is of excessively rare occurrence. The treatment is based on the same principles as those indicated in the case of movable kidney.

Malformations of the kidney.—Congenital deviations from the natural form and size of the kidney are frequently the result of fusion of both organs, and, even when involving only one kidney, are generally accompanied by misplacements.

Perhaps the commonest malformation is the so-called *congenital atrophy* of the kidney. The next most common is the *horse-shoe kidney* already described.

The renal organs may not be in any way joined, but one or both of them may be malformed, *lobulation* very frequently constituting the deviation from the normal contour. Sometimes the only malformation is at the pelvis of the kidney, or the hilum may be absent.

In some cases the deformity seems to have depended upon the relations of the blood-vessels immediately in contact with the misplaced organ.

Besides the horse-shoe form of *solitary kidney*, there is a variety of malformation in which the two lateral portions approach one another more and more until they form a disc-like kidney lying in the middle line, provided with a double or single pelvis.

INJURIES OF THE KIDNEY.

Subparietal injuries.—These are by far the most common, and in them no open wound communicates with the injured organ.

The kidney is not unfrequently *ruptured* by crushes and direct blows on the abdomen and loin, or by falls from a height without any injury happening to the parietes. The degree of laceration varies.

Blood is usually extravasated in considerable quantity into the circumrenal cellular tissue, and hæmorrhage may occur when there is no laceration whatever of the renal substance. In some cases the ureter, as well as the pelvis of the kidney, may be so completely plugged by extravasated blood as to permanently occlude the channel from the kidney to the bladder. When complete rupture is associated with laceration of the peritoneum, the hæmorrhage may be so copious as to prove suddenly fatal. On the other hand, the kidney may well-nigh be converted into a pulp without any extravasation of blood into the surrounding tissue. A partial laceration of the pelvis or ureter may be followed by adhesive inflammation, and obliteration of the urinary duct.

Symptoms.—Hæmaturia following an injury to the loin is not necessarily symptomatic of ruptured or lacerated kidney; and, on the other hand, serious lesion of the organ may occur without giving rise to hæmaturia. The earliest symptom in many cases of subparietal injury is pain in the renal area, shooting down perhaps to the testicle or thigh. There may be frequent and painful micturition, the urine voided being highly mixed with blood. There may, on the other hand, be complete suppression of urine, a symptom suggestive of injury to both kidneys, attended by plugging of the renal vessels. Swelling of the belly has in certain instances come on rapidly, and been attended with fluctuation. If the injury has been inflicted from the front of the body, signs of traumatic peritonitis may set in.

When there is an absence of blood in the urine, injury to the kidney must nevertheless be suspected if there are pains in the renal region, collapse, or the appearances of internal hæmorrhage, fulness and dulness of the injured loin, and rigidity of the corresponding abdominal muscles.

Though unfavourable, the *prognosis*, in cases of rupture of the kidney, its pelvis, or ureter, is not so grave as that in rupture of other abdominal organs. Death may be due to collapse, hæmorrhage, or peritonitis ; or later on to pyæmia, cystitis, or exhaustion from abscesses. The two chief conditions upon which recovery depends are the escape of the peritoneum, and of the large branches of the renal artery and vein.

Treatment.—Absolute rest in bed ; subcutaneous injections of anodynes to relieve pain ; half-drachm doses of liquid extract of ergot every two or three hours to check hæmorrhage ; sucking of ice to relieve thirst. Strapping the affected side will sometimes ease pain considerably. The bowels, if full of solid fæcal matter, may be evacuated by enemata, otherwise the less they are disturbed the better. The quantity of fluids taken into the stomach should be limited as much as possible. If sickness is present it is very important to check it as soon as possible by appropriate remedies.

If there is reason to think that hæmorrhage is going on, ice bags or Leiter's tubes should be applied to the loin and ilio-costal area of the abdomen. If arterial hæmorrhage from the urethra continues, and threatens life, despite all previous efforts to check it, an exploratory incision into the loin, followed, if necessary, by nephrectomy, should be practised. If clots accumulate in the bladder, or are forced on into the urethra, and give rise to much pain and distress, median urethrotomy or lateral prostatomy should be performed.

Penetrating wounds of the kidney.—These may be inflicted upon the posterior surface only, in which case they do not involve the peritoneum ; but when they affect the front surface they not only implicate the peritoneum but very probably some of the other viscera as well.

Symptoms.—Severe pain in the renal region, occurring immediately upon the reception of the injury, and frequently extending along the ureter to the testicle, and even to the thigh. Hæmaturia may or may not be an early symptom. If the wound in the kidney is deep, blood and urine may escape from the external opening or be extravasated into the retro-peritoneal tissue, or into the peritoneal cavity. Frequent and urgent, but abortive attempts at micturition, may be a prominent sign. Nausea, vomiting, rigidity of the parietes on the side injured, a feeble pulse increasing in rapidity, anxious countenance, and other indications of loss of blood are among the symptoms. If urinary extravasation invades a wounded peritoneum traumatic peritonitis will soon show itself. In gun-shot wounds, inflammation, more or less wide-spread, is inevitable ; in punctured or incised wounds it may be escaped. Rigors indicate the occurrence of suppuration ; pus in the urine is frequently noticed in cases of pyelitis resulting from gun-shot wounds.

If a wound in the renal region is followed by the passage per urethram of bloody urine or pure blood, the *diagnosis* is pretty conclusive. If such a wound is followed by dysuria, or retention of urine, there is good reason to diagnose either a superficial wound or a deeper wound of the organ with plugging of ureter with blood clot. Hæmaturia, followed by peritonitis, or the escape of urine through the external wound, leaves no doubt as to the nature of the diagnosis in wounds of this region.

Prognosis.—Incised wounds may heal rapidly, and without suppuration, whereas gun-shot wounds are followed by more or less sloughing and suppuration, and all the risks to which these processes expose the patient.

The sources of danger from penetrating renal wounds are: (1) Hæmorrhage, if the great vessels of the organ are wounded; (2) peritonitis, if the front surface of the organ or any of the adjacent viscera are penetrated; and (3) perinephritis, perinephric abscess, and effusions of blood, or blood and urine, behind the peritoneum. If the wound be inflicted upon the posterior surface, and neither peritoneum nor the great vessels of the hilum are wounded, recovery may be expected. An unfavourable prognosis must be given (*a*) when there is much extravasation, (*b*) if a foreign body remains in the wound, or (*c*) if the peritoneum has been torn.

Treatment.—If the patient is plethoric, and has not lost much blood in the first instance, the application of numerous leeches to the loin or side of the abdomen will be of service should fever or traumatic peritonitis occur. Any foreign body which may have been carried into the wound must be searched for carefully with the probe or finger; and, if necessary, the wound should be enlarged for its removal. Complete rest; small quantities of milk, and barley-water or linseed tea; opium to relieve pain and muscular spasm; and ice, to allay vomiting, are the points to attend to in the treatment during the first week or two after a wound of the kidney.

If the large bowel is loaded, mild purgatives and emollient enemata are indicated; but after it has been once freed of its contents the quieter it is kept the better.

The wound should be left open for drainage, unless it be a very large incised lesion, when one or more deep sutures may be introduced to bring the edges together in part of their extent.

A drainage tube and a piece of lint soaked in carbolised oil, and over this a layer of absorbent cotton wool, are the only dressings needed for these wounds. If at a later period phlegmonous inflammation or extravasation occur, free incisions are most important; and if a circumscribed collection of urine or blood is formed, repeated aspirations may effect a cure. Hæmorrhage should be treated on the principles already described, as indicated in the case of subparietal injury. The importance of removing clots of blood from the bladder cannot be too fully emphasised.

Prolapse of the kidney (injured or uninjured) through an external wound.—The prolapse may take place primarily, that is, at the time of the infliction of the parietal wound; or secondarily, that is, some time after the infliction of the wound, as the consequence of coughing, sneezing, or some other considerable muscular effort.

If the protruding kidney is not severely contused or completely broken up, and if the source of the hæmorrhage is not a branch of the renal artery or vein, and the bleeding can be controlled without securing either of these trunks, the organ ought to be replaced in a young person of good constitution.

PERINEPHRIC EXTRAVASATIONS.

Air.—Air is occasionally found in considerable quantity around the kidney after injury to that organ. The source of the air is not always traceable. In one case it appeared to have gained admission through a perineal incision which had been made on account of a rupture of the urethra, which complicated a fracture of the pelvis. Wounds of the loin, groin, and perinæum, whether complicated by wounds of the bowel or not, and fractures of the lower ribs, with injury to the lung, may be the causes of this form of extravasation. Retro-peritoneal abscess opening into the bowel may give rise to it.

Blood may be effused around the kidney from a ruptured artery or vein, or from capillaries, as a result of violence. The clots so formed may ultimately break down and lead to suppuration. Fractures of the pelvis or lumbar vertebræ, ruptures of muscles, and the bursting of an aneurism of the abdominal aorta, have been the causes of considerable circumrenal hæmorrhage. The kidney may be raised so completely by the extravasated blood as to present a tumour anteriorly in the hypochondrium.

The *symptoms* vary with the cause and extent of the extravasation. When the blood occupies the cellular tissue of one loin, chiefly or entirely, it causes a tumour, sometimes difficult to diagnose from a distended kidney. If the source of the bleeding is a superficial laceration of the kidney, or a rupture of an artery (say one of the lumbar arteries), some weeks may elapse before the effusion is sufficient to give rise to any swelling or increased dulness in the loin, and no sign of faintness is noticed at any time; then, after some time longer, the effused blood becomes more solid, and the tumour more irregular, and by degrees, perhaps, it is absorbed. On the other hand, the blood and clot may disintegrate, under which circumstances the symptoms of suppuration will arise.

Recovery may take place after very extensive traumatic hæmorrhage; but retro-peritoneal hæmorrhages due to ruptured aneurism are almost certainly fatal, though, it may be, tardily so.

If the hæmorrhage increases, or suppuration occurs, and surgical aid is not brought to bear upon the case, death may occur from peritonitis, due to tension upon or rupture of the peritoneum; or the colon may be penetrated, and fæces and flatus enter the blood tumour, and give rise to decomposition, septic absorption, and death.

When hæmorrhage is due to aneurism little or nothing in the way of treatment will avail; when due to injury the treatment must be based upon the principles stated in dealing with injuries to the kidney.

Urine is extravasated into the loin behind the peritoneum from ruptured kidney, or from direct penetrating wound, the result of operation or accident, or as a consequence of ulceration of these parts. Ulceration of the ureter, due to injury or the pressure of a tumour, may cause urinary extravasation into the loin or iliac region. The inflammation of the cellular tissue, resulting from urinary infiltration, may run on to suppuration, giving rise to a lumbar or inguinal abscess. If the quantity of urine effused is small, the cellulitis, stopping short of suppuration, may become chronic, spreading towards the iliac fossa, and causing contraction of the ilio-psoas muscle. In some instances the effused urine becomes encapsuled within a thick-walled cyst of inflammatory origin, with the cavity of which the kidney communicates at the point of rupture or ulceration. Sometimes phosphates accumulate in the space or cavity occupied by the effusion to such an extent as to form deposits, which block the drainage tubes used in treating this extravasation by lumbar incision.

Treatment.—When the diagnosis is uncertain, but from the fulness and dulness of the loin there is reason to think that urine is escaping behind the peritoneum, an aspirating needle should be inserted at the spot indicated. In cases where the effusion continues, and the swelling in the side again and again re-forms, a lumbar incision and drainage are needed. Suppuration must be dealt with by early free incision. If the kidney is greatly damaged nephrectomy will be requisite.

PERINEPHRITIS AND PERINEPHRIC ABSCESS.

Perinephritis is inflammation of the cellular and adipose tissue surrounding the kidney. It may occur at any age, having been met with in quite young children.

Perinephric abscess is applied alike to all forms of pus formation in these tissues. It is rare before puberty.

Perinephric abscesses are :

(1) *Primary* extrarenal abscesses, or those which are independent of any fistulous opening into or other disease of the kidney. These may depend upon injuries, chills, etc., or may follow the acute exanthemata ; or the abscess may have extended from a distant part, as the spine, pelvis, etc.

(2) *Consecutive* extrarenal abscesses ; in which inflammation of the kidney has spread to the celluloadipose tissue (*a*) by contiguity, but without urinary infiltration ; or (*b*) as a result of a fistula communicating between the renal cavity, or substance, and the surrounding cellulo-adipose tissue. This form is usually

due to suppurative pyelitis, or to tubercle, cancer, hydatid or other form of cystic disease, or to calculus of the kidney.

(3) Consecutive to disease of another organ than the kidney, *e.g.* colon, testis, liver, or one of the pelvic organs.

Symptoms.—These vary with the cause and acuteness of the disease. When the inflammation is secondary to some distant disease, such as pelvic cellulitis, the symptoms of the primary affection may disguise those of the perinephritis.

The constitutional indications of pus in the circumrenal connective tissue are the same as those excited by deep-seated suppuration elsewhere. The febrile temperature in some cases runs continuously high; in others it is intermittent, and suggestive of malaria or pyæmia. Obstinate constipation is almost invariable.

Of the local symptoms, those due to pressure are more marked in perinephric abscess than in perinephritis. Pain, deep-seated and often paroxysmal, ushers in the disease; sometimes dull and aching, at others darting, it courses along the distribution of the lumbar plexus. The pain is greatly intensified by bimanual compression of the loins.

The affected side will impart a sense of increased resistance and weight long before pus has formed, or the abscess large enough to alter in any way the contour of the part. The skin in the loin is often waxy and œdematous. Fluctuation is frequently very remote, owing to the thickness of the parietes, and in one case six pints of pus were pent up, but, on account of the great depth of the subcutaneous fat, no fluctuation could be detected. Œdema of the foot and ankle has preceded for many weeks every other sign of perinephric abscess. A peculiar lameness is often an early symptom which is due to the flexed position in which the thigh of the affected side is retained to relieve tension.

Perinephritis without suppuration.—The spinal column is preternaturally stiff, and the body in walking is inclined over to the affected side. Stooping is difficult. In the recumbent posture the patient will not extend the corresponding thigh beyond 160°, or in severe cases 130°. There is sometimes pain in the knee. These conditions together cause the case to resemble the second stage of hip disease, especially when the thigh is rotated outwards, so that the heel of the affected side during standing rests on the dorsum of the opposite foot. In perinephritis there is no tumefaction to be felt in the loin, as in perinephric abscess.

Prognosis.—In a few cases, perinephritis ends in resolution before the suppurating stage has been reached. When suppuration occurs, the prognosis depends chiefly on two things, the early and free evacuation of the pus, and the cause of the disease.

When the abscess is primary, *i.e.* not dependent upon renal or other visceral or spinal disease, an opening into it is soon followed by convalescence. If the abscess bursts into the peritoneum, rapidly fatal peritonitis is extremely probable.

Diagnosis.—The affections which may be mistaken for perinephritis or perinephric abscess are lumbago, various organic diseases of the kidney, spinal caries, splenic tumours, fæcal accumulations in the colon, morbus coxæ, and psoas abscess.

The higher situation of the pain; the tenderness in the loin; the fact that passive flexion is painless in itself; the free, painless mobility of the hip joint; the absence of tenderness and fulness over the upper end of the femur; absence of pain on percussion of the thigh; and the less rigidity of the adductors and rotators, serve to distinguish perinephritis from hip disease.

The symptoms of perinephritis are very closely allied in many points to those which accompany *perityphlitis* and *typhlitis;* but the characteristic feature of perinephritis is, that the pain, tenderness, and swelling are first observed and most pronounced in the iliocostal interspace behind, whereas in typhlitis and perityphlitis they are located in the iliac fossa and in front.

Treatment.—Primary perinephritis may be sometimes checked in its early stages by local depletion, hot baths, and poultices. In subacute or chronic inflammation absorbent ointments containing lead or potassium iodides are useful. The bowels must be opened at the onset by a brisk purgative, and kept moderately active. Pain is relieved by morphia. The diet should consist of beef-tea, milk, light puddings, and such like. Directly the presence of pus is suspected it should be searched for by an exploratory incision, and if detected should be let out through a free opening in the loin. The abscess should then be washed out with a solution of iodine or carbolic lotion, and a drainage tube inserted. The subsequent treatment must be conducted on general principles. Consecutive abscesses, and also some of the less acute forms of primary abscess, must not be allowed to close too early.

Abscess of the Kidney

occurs as a consequence of the coalescence of a large number of miliary abscesses. Metastatic and secondary abscesses of large size may be due to obstruction of large vessels by emboli. Stricture or other disease of the lower urinary organs may also give rise to a circumscribed abscess in the tubular substance of the kidney. Other occasional causes are blows, wounds, and kicks. Renal calculus is one of the most common causes of large renal abscess. Circumscribed abscess usually affects only one kidney, and in a large number of cases the whole organ, including the pelvis, is involved.

The constitutional *symptoms* are those which are ordinarily significant of the formation of pus. Hæmaturia often precedes abscess when the cause is traumatic. The absence of pus in the urine is no criterion, because in many cases there has been none detected throughout. If, however, the abscess has broken into the renal pelvis or ureter, the urine may abound in pus. If a tumour has formed in the loin, the discharge of pus by the bladder will probably be followed by a subsidence of the swelling. In the acute cases a fatal termination must be anticipated within about three weeks or less. Possibly, recovery may ensue, the contents of the abscess becoming inspissated and remaining quiescent for the rest of life.

Treatment.—If the cause be external violence, rest, anodynes, depletion, or the application of an ice bag, constitute the principles of treatment of abscess in the early stages. After the first day or two of the inflammation hot fomentations must be continuously applied. If there is clear indication of a renal abscess, the pus ought to be evacuated through an incision in the loin. If, when the kidney is exposed, pus is found, it is not sufficient to evacuate it with a trocar and canula. A free incision having been made into the abscess, its wall, if the cavity is large, should be stitched to the edge of the wound. If, however, the kidney should be found much destroyed, it would be better to remove it.

TRAUMATIC NEPHRITIS.

Causes.—Wound or contusion of the substance of the kidney, violent muscular strain, the presence of a calculus or of parasites. When blood has been extravasated into the cavity of the kidney, and the urine retained there in consequence of impaction of a blood clot in the ureter, pyelitis and pyelo-nephritis may arise.

Symptoms.—Rigor; fever; pain not constant, and very variable in degree, deep-seated and referable to the loin, sometimes diffused over a considerable area of the abdomen, and rarely of a throbbing character unless the perinephric tissue be also involved. Nearly all movements aggravate the pain. If the disease sets in soon after an injury, the urine always contains a trace of blood. Subsequently, in a few cases, pus may be found in the urine.

There is a disposition to the formation of gravel and calculus, and, as a consequence, to renal colic, after wounds or concussions of the kidney.

Traumatic nephritis is not usually serious, provided the damage inflicted on the kidney is not great and the large vessels are not ruptured. If severe, the kidney may be softened down into a mere pulp.

Treatment.—If the kidney has been penetrated, urine will drain away by the external wound. If the organ has been opened by subparietal laceration or rupture, the chief danger when the large vessels are uninjured is from infiltration of urine into the cellular tissue. Then it may be necessary to lay open the loin by a free incision down to the injured kidney, so as to provide for the free drainage of the extravasated urine and inflammatory products.

When there is no extravasation, small quantities of fluid diet, the application of cold or leeches, relief of the bowel by one good purgative or enema, and opium to relieve pain, constitute the usual necessary details of treatment.

Renal Fistulæ.

Fistulæ which communicate with the kidney and pelvis of the kidney.

Causes.—Renal fistulæ are caused, in the great majority of cases, by calculi in the pelvis of the kidney or in the ureter. Other causes are gun-shot, punctured, or incised wounds, injuries inflicted by surgical operation, and abscess of the kidney. The opening into the cavity of the kidney or ureter is usually single and connected with the posterior aspect of the organ. Renal fistulæ may open at the loin or groin into the colon or duodenum, into the pleural cavity or lung, or into the peritoneum. It is comparatively rare for a fistula to open into the peritoneum. If the fistula result from a wound or a ruptured hydro-nephrotic cyst, *urine*, sometimes in large quantity, will escape from it; if from pyo-nephrosis due to ureteral obstruction, *pus* will be mingled with the urine; if from the conversion of the kidney into a scrofulous abscess cavity, the discharge will consist of *pus*.

Renal fistulæ which open in the loin.—When a fluid of a urinous character escapes from a fistula which followed an attack of nephritis or injury to the kidney, the diagnosis as to the renal origin of the fistula is certain. It must be remembered, however, that a lumbar fistula, instead of communicating with the kidney at all, may be the result of disease in the lower urinary passages, *i.e.* in the ureter, bladder, or even the urethra.

Treatment.—The parts around the orifice must be kept clean, and free from irritation. If, after a fair length of time has been allowed for spontaneous closure, the fistula persist, caustics, the hot iron, or an incision, so as to lay open any sinuous track, vivify callous edges, or remove spongy granulations or calculous deposits, must be tried. The injection of iodine solution sometimes will stimulate the sinus to healthy action.

If the other kidney be sound, and a permanent fistula communicating with a diseased organ, threatening the life, and sacrificing the comfort of the patient, resist other treatment, the best plan is to perform nephrectomy.

Renal fistulæ opening into the stomach.—These are of extremely rare occurrence. In one case of communication of the left kidney with the stomach pus, urine, and calculi are said to have been vomited; but there is a considerable degree of uncertainty as to the genuineness of the symptoms and accuracy of diagnosis. In a case of gastro-renal fistula due to scrofulous pyelo-nephritis, admitted under the writer into the Middlesex Hospital in 1884, there was a history of "inflammation of the bladder" and of "pus in the motions," as well as in the urine. There were four sinuses in the back discharging pus. Careful examination of the chest and abdomen disclosed nothing. No physical signs of pelvic cellulitis or circumrenal abscess could be made out. Complete anuria preceded death. On post-mortem examination the only communication between the kidney and the gastro-intestinal tract was a fistula of the diameter of a crow-quill, opening into the left margin of the great curvature of the stomach.

Renal fistulæ communicating with different parts of the intestine, and renal fistulæ opening into the lung, are of very rare occurrence. Prompt surgical treatment might in some instances have prevented their occurrence.

Ureteral fistulæ are almost invariably the results of operation wounds.

Hydro-nephrosis.

This term is given to over-distension of the kidney with urine, the result of mechanical obstruction, no matter whether the cause be in the urethra, bladder, or ureter. Probably one-third of the cases of hydro-nephrosis in which a palpable tumour is formed have a congenital origin.

Congenital causes.—Twistings, undue obliquity, contractions, and other anomalies of the ureter. This duct is in some cases converted into a fibrous cord, in which case the hydro-nephrosis exists at birth; or its vesical orifice may be merely of pin-hole size; or minute cysts may be developed in its mucous membrane; or the angle of its junction with the kidney may be so acute as to render the descent of the urine difficult.

Acquired causes.—Cancer of the pelvic organs. Calculus, either by its impaction in the ureter, or by the ulceration and subsequent contraction at some spot in this tube, excited by its passage to the bladder. Other causes are inflammations, tumours, or abscess of the bladder, causing contraction of the vesical orifice of the ureter. A papilloma of the bladder has been a cause; other causes are enlarged lymphatic glands, adhesions or bands of fibrous tissue, enlarged prostate, and stricture of the urethra. Hydro-nephrosis may affect both kidneys, or only one, or may be limited to only a part of one kidney. Cases of double hydro-nephrosis are commonly of congenital origin. The proportion of cases in which hydro-nephrosis produces a palpable abdominal tumour is very small compared with the frequency of the existence of the disease.

Pathology.—The pelvis of the kidney first becomes converted into a spheroidal sac, then the calyces are widened and stretched in every direction, and at length the capsule of the organ is expanded, and what remains of its cortical and medullary substance becomes still further compressed and absorbed until nothing is left but a loculated cyst. The size of the hydro-nephrotic sac may not exceed that of a normal kidney, it may even be smaller; or, on the other hand, it may be sufficiently large to form a swelling occupying a great part of the abdominal cavity. The contained fluid is only water holding a larger amount of sodium chloride than exists in urine, and a few epithelium cells. Its quantity is sometimes enormous, reaching several gallons.

Symptoms.—Hydro-nephrosis may occur at any age, and is twice as frequent in females as in males. When the dilatation is insufficient to give rise to a tumour, there are generally no symptoms characteristic of hydro-nephrosis. Out of a series of 142 Middlesex Hospital cases, an abdominal tumour was formed in but very few. In some advanced cases in which no tumour exists, there are thirst, pain in the back, frequent micturition, partial, total, or intermittent anuria, and obscure or pronounced abdominal pains.

A hydro-nephrotic tumour is dull on percussion, sometimes lobulated in contour, and frequently fluctuates. It has all the characters of a renal tumour, being situated in the flank, pressing backwards and outwards the ilio-costal parietes, having the colon in front of it, and the small intestine either in front or thrust over to the opposite side of the abdomen, according to the bulk of the swelling. If of no great size it may be painless; if large, it may give rise to excruciating suffering.

When it arises from some innocent cause as pregnancy or uterine flexion, its development is unattended by any constitutional or local disturbance; but when from some painful cause, such as impacted calculus, the symptoms incidental to the particular cause will occur before the tumour makes its appearance, and may cause it to be overlooked.

There are instances of the tumour *intermitting*, *i.e.* being prominent at one time and not distinguishable at another.

Diagnosis.—When of moderate size, it has to be distinguished from renal, or perinephric abscess, and perinephric extravasation. When it forms a palpable tumour, it may be mistaken for pyo-nephrosis, or for a hydatid or serous cyst of the kidney, liver, or spleen. When of great size it may simulate ascites or ovarian dropsy. If the subsidence of the tumour is followed by an increase in the outflow of urine, the diagnosis as to its hydro-nephrotic nature is well nigh certain. Perinephric abscess is quicker in its course, and excites much more pain and constitutional trouble in its early stage. Between hydro-nephrotic and pyo-nephrotic tumours the diagnosis is often impossible.

Purulent urine, rigors, and fever, indicate pyo-nephrosis as a rule, but such diagnostic symptoms may be absent. Hydatid and serous cysts of the kidney are best diagnosed by their history.

From ovarian tumours the diagnosis is often very difficult. These are, as a rule, more mobile than renal cysts, and enlarge upwards from the pelvis, not forwards from the loin. Moreover, the intestines are behind an ovarian and in front of a renal tumour. When the tumour is renal the uterus is neither displaced nor fixed.

Prognosis.—This in great measure depends upon the distension, but chiefly upon whether one or both organs are involved. If only one kidney is affected and the tumour not large, life may be indefinitely prolonged. If the distension increases, death will result from pressure on neighbouring organs, rupture into the peritoneum or from suppression of urine and uræmia.

Treatment.—Medical remedies are of no avail. When of small size and painless, these hydro-nephrotic tumours may be left alone. When they cause trouble, owing to pressure, they should be aspirated, unless, from the nature of the case, re-accumulation is pretty certain to recur again and again.

Friction of the tumour has proved successful in overcoming the obstacle to the passage of the urine. If paracentesis is decided upon, and there is nothing to particularise any spot for puncture, the best point to tap a tumour of the left kidney is one just anterior to the last intercostal space; but if the right kidney is affected this is too high, and the puncture should be made half way between the last rib and the iliac crest, and two inches behind the anterior superior spine of the ilium. Repeated tappings will probably be required. Nephrotomy is the proper operation for cases in which aspiration has failed. Drainage and antiseptic irrigation are effected by means of a large rubber tube, which should be fixed in the cyst, and Condy's fluid or weak carbolic solution should be passed through it daily.

Congenital Hydro-Nephrosis.

In by far the larger number of cases of hydronephrosis, found in the fœtus and new-born, both kidneys are involved, the most common cause being imperforate urethra. It may be due to minute cysts, or membranous septa in the urethra, or to cysts in the ureter or pelvis of the kidney. The subjects of this disease may be born dead, or may live for a few weeks, months, or even years.

The urine removed from some of the cases of congenital hydro-nephrosis has contained little or no urea. The size of a hydro-nephrotic fœtus has proved a serious impediment to labour in several cases, and has rendered parturition impossible, until the abdomen of the child has been reduced by tapping.

Congenital hydro-nephrosis is frequently associated with some other congenital deformity, such as hare-lip and club foot. It proves that the secretion of urine goes on to a very considerable extent during the latter half of intra-uterine gestation; and that when any obstacle to the outflow of urine exists, the same pernicious effects of distension of the bladder, ureters, and kidneys occur before birth as are commonly known to arise from urethral stricture, calculus, and other causes of obstruction after birth.

PYO-NEPHROSIS.

This term implies dilatation of the pelvis and calyces of the kidney, with pus, or pus and urine. In advanced cases, the dilatation and suppuration extend beyond the calyces, and go on to compression and disintegration of the medullary and cortical substance, converting the organ into a large loculated sac, the nature of whose contents depends on the cause of the obstruction.

Hydro-nephrosis becomes pyo-nephrosis as soon as suppuration occurs; and, therefore, the causes which produce pyo-nephrosis are similar to those which generate hydro-nephrosis. When an obstruction causes pyo-nephrosis at once, it is more complete in its character, and more rapid in its irritative effects upon the kidney, than when it causes hydro-nephrosis first. In some cases of pyo-nephrosis, the pyelitis, instead of following, has preceded the obstruction. As a result of pyelitis, a clot of blood, or a little mass of inspissated pus; or, again, a fragment of diphtheritic, cancerous, tuberculous, or semi-organised false membrane, may block the ureter.

Symptoms.—In the early stages, the symptoms are those excited by the cause of obstruction, whatever that may be; and in addition those of pyelitis.

If the obstruction be not complete, there will be pus in the urine; if intermittent, there will be intervals during which no pus is discharged; if complete and permanent, there will be an entire absence of pus in the urine. There will be constitutional symptoms of suppuration, and when the pyelitis is very chronic, all the characters of hectic. When a tumour forms in one or other loin, its characters are similar to those of hydro-nephrosis, already described. The urine should be repeatedly examined, and its varying quantity and constituents carefully noted.

Diagnosis.—The tumours which may be mistaken for pyo-nephrosis are those resulting from morbid enlargement of the spleen, hydro-nephrosis, and other renal tumours, hydatids, abscesses, and aortic aneurisms. Pyo-nephrosis is usually characterised by febrile symptoms; the pain of the tumour is increased by pressure over it, and by movements of the trunk; and when the ureter is not actually occluded, there is more or less pus in the urine. Not only should the nature of the tumour be ascertained, but the urethra, prostate, and bladder should be carefully examined, with the view of diagnosing the cause of obstruction.

Prognosis.—In cancer of the pelvic organs, suppuration in the vesical walls, the impaction of a calculus on one side with disease of the opposite kidney, the fatal prognosis is determined by the nature of the cause. When pyo-nephrosis, of one side only, is produced in persons with previously healthy kidneys, by some cause which occludes the ureter and does not interfere with the opposite kidney, the prognosis, as regards life, at least, is good, if early relief to the pent-up urine and pus be given.

Treatment, in the early stages, consists in the removal, if possible, of the cause of obstruction and distension, and the improvement of the pyelitis.

Palliative treatment of the tumour is permissible where there is not complete obstruction, and the pus and urine can escape by the ureter. In many instances, however, the proper treatment is nephrotomy, palliatives being useless, and delay dangerous. The circumstances which indicate nephrotomy are: constant pain, increasing size of the tumour, continued fever, severe gastric and intestinal disturbance from pressure, inflammation and adhesion of surrounding structures, and threatened ulceration and rupture of the tumour into them.

HÆMATURIA.

Sources of the hæmorrhage.—The blood contained in the urine may have its origin in any spot in the urinary apparatus. When occurring as the result of an injury to, or well-marked disease of, one of the urinary organs, the signs indicative of the source of the bleeding will in many cases be unmistakable.

In those cases, however, in which blood is passed "per urethram," and there is nothing in the history of the condition or surrounding circumstances to afford any information as to the source whence it is derived, the following considerations, though not absolutely conclusive, will nevertheless prove of considerable assistance in an endeavour to determine this point.

(1) If through the whole volume of urine which has been voided the blood is pretty uniformly diffused, the probability is that it comes primarily from the kidney.

(2) If the urine expelled is at first clear and normal in colour as it issues from the urethra, and becomes more and more deeply tinged with blood as the act of micturition proceeds, till at length the residue of the voided fluid consists of almost pure, if not quite pure, blood, the source is most likely located in the bladder.

(3) If at the commencement of micturition a jet of more or less pure blood is expelled, and the urine, as it escapes, almost at once becomes clear and remains so to the last drop, the origin of the bleeding may be referred to the mucous membrane of the urethra: blood may ooze from the urethra independently of micturition.

Causes of renal hæmaturia.—(1) Simple contusion of the kidney.

(2) Temporary congestion of the cavity of the kidney without any breach of surface.

(3) Hæmaturia of a temporary character may be caused by an embolism or thrombus within the kidney.

(4) Inflammation extended to an uninjured kidney from the muscular or circumrenal cellular tissue of the loin which has been damaged by injury.

(5) Slight hæmaturia has followed simple shaking of the kidney, as in horse exercise.

(6) Intermittent hæmaturia may result from Bright's disease, calculus, or uric acid diathesis. It may be vicarious.

(7) Hæmorrhage from the kidney may result from catheterism, especially in elderly men with prostatic disease and who for a long time have but imperfectly emptied their bladder. It might happen to a young man of debilitated constitution after a fit of painful retention.

Symptoms of hæmorrhage from the kidney the result of catheterism.—The hæmaturia occurs after the withdrawal of the urine, no blood being noticed in the urine which is taken away the first time the catheter is used. On the second occasion the urine withdrawn will be from first to last mixed with blood to a greater or less extent, according to the degree of congestion, or the number and size of the vessels which have given way. Subsequently, each act of micturition, or each introduction of the catheter, for some days will be attended with the escape of blood mixed with the urine throughout. Sometimes no indication of mischief will be experienced until the blood is actually seen; in other cases the relief of retention by catheterism may be soon followed by pain referred to the neck of the bladder, a sense of weight in the hypogastrium, with a frequent desire to micturate. Perhaps it is the liability of the hæmorrhage to be followed by pyelitis and cystitis, rather than the actual loss of blood, which is the chief source of danger. If bleeding is very free, clots are formed either in the pelvis of the kidney or in the bladder. If in the kidney, the passage of clots along the ureter will generate symptoms resembling those of renal colic; if in the bladder, the symptoms will be referred to that organ or the urethra.

Diagnosis.—Urethral hæmorrhage is negatived because the blood from this source flows independently, or at the starting, of micturition.

Prostatic hæmorrhage can usually be excluded on the same ground. Vesical hæmorrhage is improbable, because, the bladder being a collapsing organ, the mucous surfaces fall together and receive some support from the surrounding viscera. That the hæmorrhage in such cases as we are considering comes from the congested vessels of the kidney, and is not due to cancer, calculus, tubercle, etc., the history and mode of onset of the bleeding will in most cases clearly show.

Prognosis.—This must always be serious in old men with prostatic trouble, or in young men who have a hæmorrhagic tendency. As has been before stated, pyelitis and cystitis constitute probable sources of danger. The bleeding may itself be a sign of great peril in enfeebled subjects.

Treatment.—To prevent the occurrence of hæmorrhage, great care should be taken before the first catheterism. The catheter should never be used, at least on a first occasion, upon a person while standing, or in any other than the recumbent posture, and the instrument should be of such a calibre (No. 6 or 7) as to prevent too rapid emptying of the bladder. Neither coughing nor straining on the part of the patient, nor hypogastric pressure by the surgeon's hand, should be permitted.

When hæmorrhage has commenced, no effort should be made to check it by applying ice externally. Warmth and rest in the horizontal position, and restricted simple diet are indicated. Ergot of rye is the most useful of drugs, given in half drachm doses of the liquid extract every few hours. Gallic acid in 10-grain doses does very well, as does also tincture of perchloride of iron. Opium quiets the nervous system and steadies the circulation.

If clots accumulate in the bladder they must be removed through a double-action catheter, and the bladder should be irrigated with warm water. If there is any difficulty in washing out the clots, and their presence has excited much vesical irritability, external urethrotomy, or lateral cystotomy, should be performed and the bladder freely drained.

Morphia suppositories relieve irritability of the bladder, and enemata should be employed to keep the rectum empty.

RENAL CALCULUS.

If the crystalline particles which are normally held in solution in the urine are deposited in excess, and happen to become cemented together by a fragment of mucus or blood clot, and are subsequently added to by fresh depositions from the urine, a calculus is constructed, which may either be discharged with the urine, causing more or less renal colic in its transit along the ureter; or may remain behind in one of the calyces, or in the pelvis of the kidney, there to grow by fresh accretions, until it attains a size altogether in excess of anything which can pass along the ureter. Calculi may originate in the uriniferous tubes, or in one of the calyces of the kidney.

The most common form of renal calculus is the uric acid, the next most common the oxalate of lime; but carbonate of lime, phosphate of lime, a mixture of phosphate and the ammonio-magnesian phosphate (the fusible calculus), cystine, xanthine, urate of ammonium, or the mixed urates, are occasionally, though rarely, found as the nuclei or chief constituents of renal stones. Alternating calculi of uric acid, oxalate of lime, and phosphates in distinct layers, are not uncommon. A drop of dried blood occasionally constitutes the nucleus. Renal calculi are formed at all periods of life, but they are of most common occurrence before the age of fifteen and after fifty.

The nucleus in the case of an infant is usually formed of ammonia urate, that in a person of about fifteen or sixteen years of age consists of uric acid, whilst after the fortieth year oxalate of lime constitutes the nucleus. One or many calculi may be formed in the same kidney ; when composed of lime oxalate the calculus is usually single.

A renal calculus may be a small, round, smooth body, or a large rough branched mass filling all the pelvis and calyces. A stone as large as a marble, sharply mammillated on its surface, may remain confined to one of the calyces for years without giving rise to more change than induration of the whole organ, due to slight or chronic interstitial inflammation. On the other hand, quite a minute stone, not much, if any, larger than a mustard seed or grape seed, whilst in the tubular structure of the kidney, will excite congestion, and even acute inflammation and abscess.

Symptoms.—A small stone may develop, travel, and escape without giving rise to any symptom. A stone of large size may exist for years without causing any noticeable symptoms.

As a rule, there is at some time blood or albumen mixed with the urine, some lumbar pain or aching, some vesical irritability, and perhaps some pain in the testicle. If the stone has existed a long time, pus, mucus, or albumen will be found daily in a minute, or moderate, or marked quantity in the urine. As soon as a stone enters the ureter, or is being propelled along it, renal colic sets in, the attack coming on suddenly, lasting a few hours, or two or three days, and suddenly subsiding, to recur at some future period if the stone, instead of escaping at the lower end of the ureter, is simply displaced from the upper orifice into some less important point in the renal pelvis. Recurring attacks of colic arise also from fresh formation of renal calculus. The paroxysmal pain shoots down the course of the branches of the lumbar plexus, and is felt in the bladder, groin, or thigh, if not in all these parts, and is intensified by the spasmodic contractions of the ureter. Collapse and faintness are not uncommon; the bladder is irritable, and the urine blood-stained and loaded with urates. The attack is often ushered in with a rigor, and generally accompanied by vomiting and profuse perspiration.

When the patient is very thin, and the stone large, it may sometimes be detected on palpation of the loin. The hæmaturia is not often profuse or constant; it is not proportionate to the size, number, or chemical nature of the stones, though it may be remembered that oxalic calculi have the roughest and therefore most irritating surface.

Pus in the urine is the consequence of inflammation of the pelvis and calyces of the kidney; mucous threads occur more frequently when the calculus is of oxalate of lime. Frequency of micturition is a symptom of great importance.

Probably the greatest difficulty in *diagnosis* is between early strumous kidney and renal calculus. When the frequency of micturition and slightly purulent urine are met with in a person of strumous habit, and are unaccompanied by a history of hæmaturia, the strumous nature of the disease is clear; but when they are associated with a history of hæmaturia, and sharp lumbar or testicular pain in an otherwise healthy looking person, calculus is greatly more probable.

Treatment.—This may be prophylactic, palliative, and surgical.

(1) *Prophylaxis.* — Moderate amount of well-selected food; animal diet in moderation; and avoidance of an excess of nitrogenous food.

(2) *Palliative treatment.* — Free use of alkaline drinks or distilled water. Saline aperients. During an attack of renal colic, the hot bath; hot opium or belladonna fomentations; subcutaneous injections of morphia; suppositories of belladonna and morphia. Warm diluent drinks may be given, and the patient should lie with the shoulders and thighs raised.

(3) *Surgical treatment.*—When the symptoms of stone are severe, and are not removed or rendered bearable by several months of medicinal treatment and rest; when, in order to diminish pain or hæmaturia, the patient is compelled to confine himself to the recumbent posture; or when anuria supervenes upon the symptoms of calculus in one or both kidneys, *nephro-lithotomy* is indicated. *The object of this operation is to save the kidney.* If, however, the organ is in great part destroyed, if there is calculous pyelitis, or calculous hydro-nephrosis or pyo-nephrosis, *nephrotomy* is the necessary measure.

If, after the kidney has been thoroughly explored, not only with the finger, but by puncture, and also by incision of the calyces, and digital examination of the interior of the renal cavity, a stone cannot be detected, and yet the symptoms point definitely to the presence of one, and the patient's life is insufferable from pain or hæmorrhage, *nephrectomy* ought to be performed.

ACUTE AND SUBACUTE INTERSTITIAL NEPHRITIS.

As a rule this condition affects both kidneys, though to an unequal extent.

Causes.—Although it may be brought on by any of the causes of obstruction enumerated under hydronephrosis, it is especially prone to occur if the kidney, previously subjected to undue pressure, is excited by reflex irritation, such as catheterism in a case of long-standing stricture or prostatic enlargement.

Symptoms.—When due to chronic obstruction the symptoms begin very insidiously, and run an irregular course; but when excited by a surgical operation the disease generally commences by a distinct rigor.

As soon as the inflammation has set in the general health becomes much impaired.

The temperature rises two or three degrees at night, the skin is hot and pungent, and there is great thirst.

There is rarely, if ever, any tenderness on deep pressure about the kidney, and pain is seldom felt.

There is never more than a trace of albumen in the urine, but when cystitis, prostatitis, or urethritis exists there may be a considerable admixture of pus or blood.

When the disease is going to terminate favourably the symptoms gradually disappear.

On the other hand, after the symptoms have lasted some time the patient dies from exhaustion, or more frequently from suppuration of the kidney.

The prognosis depends on the healthy or unhealthy condition of the kidney, and as to whether the primary cause of disease is removable or not. In cases in which the onset is attended with prolonged suppression of urine, a fatal issue may be expected.

Treatment.—The causes of obstruction to the passage of urine should as soon as possible be overcome, and retention obviated by catheterism. Stricture must be dilated or divided, perinæal abscesses opened, or enlarged prostate appropriately dealt with.

All instrumentation must be as gentle as possible.

Decomposition of the urine in the bladder should be prevented by the evening and morning irrigation of the bladder with some antiseptic wash. Rest in bed; hot dry bran or flannels to the loin, with dry or moist cupping; bland nutrient food; and the avoidance, or only very sparing use, of stimulants, constitute the principles of treatment. No medicines are of any special use.

SUPPURATIVE NEPHRITIS, PYELITIS, AND PYELO-NEPHRITIS.

Causes.—Stricture of the urethra; prostatic enlargement; vesical calculus; palsy of the bladder; congenital phimosis; cancer; blood coagula in the ureter, renal pelvis, or calyces; and in the female, pregnancy and disease of the pelvic organs.

Symptoms.—When a patient who is the subject of retention or decomposition of the urine, develops high fever, headache, somnolence, nausea, a dry, crusted, and fissured tongue, and an anxious, sallow face, and, in addition, emaciates rapidly, it is certain that pyelo-nephritis is present, and will in all probability prove fatal.

Sometimes the attack commences with a rigor; the temperature reaches in some cases 106°.

The character of the urine varies in different cases.

Diagnosis.—Pyelo-nephritis or interstitial suppurative nephritis, is to be distinguished from acute Bright's disease by the absence of convulsions, of œdema, and of the harsh, dry skin which characterises the latter affection. The urine, instead of being scanty and of a reddish-brown colour, as in Bright's disease, is abundant and purulent, and but slightly, if at all, tinged with blood.

Pyæmia is distinguished by the secondary abscesses; tender, purulent swellings of the joints; sweet, mawkish breath; and jaundiced skin and offensive diarrhœa. From enteric fever the history and course of the disease, and absence of typhoid stools, will usually constitute a sufficient distinction. Ague is not difficult to distinguish, but the diagnosis from uræmia is much more complex.

Prognosis.—This is very unfavourable, most patients dying within three or four weeks; sometimes death occurs in a few days. If, however, the fever be moderate, and the strength of the patient not exhausted, the removal of the cause of obstruction may be followed by recovery.

Treatment.—This is the same as that recommended for acute and subacute nephritis without suppuration. Quinine in full doses is sometimes efficacious in checking the rise of temperature.

RENAL AFFECTIONS SECONDARY TO DISEASE OF, OR OPERATIONS UPON, THE LOWER URINARY ORGANS.

(1) **Consequences to the kidney of disease of the lower urinary organs.**—(*a*) Hydro-nephrosis with or without chronic inflammation of the renal substance. (*b*) Pyo-nephrosis, or dilatation with suppuration of the pelvis and calyces. (*c*) Acute and subacute interstitial nephritis. (*d*) Suppurative nephritis and pyelitis. (*e*) Cicatricial kidney, or one form of granular contracted kidney, the result of recovery from simple or suppurative interstitial nephritis.

Consequences to the kidney of surgical procedures on the lower urinary organs.—The passage of an instrument along the urethra, or the performance of any operation upon it or the bladder, in some instances, especially if the kidneys are diseased, excites a febrile condition known by the names "catheter," "urethral," "urinary," and "uræmic" fever.

The varieties of this form of fever are classified according to their effects upon the kidney, as (*a*) the congestive; this occurs in a threefold manner. (*b*) The inflammatory; this may be marked by intermittent or continued fever. (*c*) The suppurative; which may also be marked by intermittent or continued fever.

In addition to urinary fever, *hæmorrhage from the kidney* sometimes results from the use of the catheter in cases of long-standing retention of urine; and *uræmia without fever* is an occasional consequence of catheterism. Interstitial nephritis and pyelo-nephritis, though they are the two most severe and fatal forms of fever which follow the use of surgical instruments, may nevertheless occur quite irrespectively of the use of instruments. The *congestive* forms of urinary fever may be excited by the simple introduction of the bougie or sound in a person with quite healthy kidneys.

The methods of production of secondary renal disease are:

(1) *Increased pressure* in the tubules from obstruction to the escape of urine.

(2) *Reflex irritation* of the kidney.

(3) *Septic matter* in the pelvis of the kidney, and possibly in the lower part of the tubules.

As a rule, increased pressure when acting alone as the result of obstruction will produce hydro-nephrosis; reflex irritation will excite one of the transient or congestive types of urinary fever, and septic matter will cause acute or suppurative pyelo-nephritis.

Urine may undergo decomposition in the pelvis of the kidney in two ways, viz.:

1. By direct extension of inflammatory changes from the bladder along the ureter to the kidney; and

2. By the changes in the urine within the pelvis of the kidney, when pyelitis is excited. Various conditions, besides some obstruction to the outflow of urine from the bladder (such as cancer of the pelvic organs, or the bursting of an abscess into the bladder) may excite cystitis, and thus lead to ammoniacal decomposition of the urine within the bladder. When pyelitis is provoked by the impaction of a renal calculus in the pelvis or ureter, or when it occurs in the course of any of the continued fevers, alkaline fermentation of the urine results, through the agency of the muco-pus which is secreted by the mucous membrane of the pelvis and calyces of the kidney.

TUBERCULOUS AND SCROFULOUS KIDNEY.

Two forms of tubercle (so-called) of the kidney are met with, viz.:

1. *Disseminated tuberculosis*, and
2. *Strumous pyelitis* or *scrofulous pyelo-nephritis*.

The first of these diseases is more common in children, and the scrofulous form often affects one kidney only, and is more frequently met with after puberty.

Tuberculous disease.—In this form minute miliary nodules are scattered through the kidney as a part of a general constitutional malady. These begin as grey granulations around the terminal branches of the arterioles which lie between the pyramids of Ferrein.

Scrofulous disease.—In strumous pyelitis, masses of cheesy infiltration commence in the substance of the renal papillæ, and extend deeply into the kidney, as well as downwards to the submucous tissue of the renal pelvis. The body of the organ is enlarged and lobulated, while its pelvis and ureter are contracted by the thickening of their mucous and submucous membranes.

Symptoms.—Disseminated tuberculosis produces no characteristic symptoms referable to the kidney.

In the early stages, *strumous pyelitis* does not give rise to marked constitutional symptoms, and local symptoms are absent. As the disease advances, there is pain in the loin, with tenderness on pressure. The urine, when it contains albumen, is always thick; not clear, or containing renal casts, as in Bright's disease. Occasionally there is suppuration and fatal uræmia. If the disease is on the left side the spleen may be so pushed forward as to give the impression that that organ is enlarged. Vesical irritation is sometimes a very distressing symptom. In the advanced stages there are marked rigors and exhausting sweats, or hectic.

Diagnosis.—In the early condition it is almost impossible to diagnose scrofulous kidney from renal calculus. The chief reliance must be placed on the well-known constitutional signs of tuberculosis. The *prognosis* is most unfavourable, and the duration of the disease very variable.

Treatment.—Anodyne applications to the loin, and anodynes guardedly administered internally, together with cod-liver oil, bark, cream, and bland nutritious diet, must be employed. If the kidney has been converted into an abscess cavity of large size, or, if suppuration has been set up in the perinephric cellular tissue, nephrotomy should be performed, and the cavity well irrigated and drained.

Nephrectomy is useless in tuberculous disease; but in scrofula, limited to one kidney, it has been a fairly successful means of prolonging life.

TUMOURS OF THE KIDNEY.

Renal tumours are among the most difficult of abdominal enlargements to diagnose correctly.

The chief **distinctive points** about them are as follow :

1. The large intestine is in front of the tumour. The right kidney, unless enlarged, lies a little way from the lateral wall of the abdomen, behind and to the inner side of the ascending colon. When enlarged the ascending colon is usually placed in front of, and towards the inner side of, the tumour. On the left side the descending colon is in front, and inclines towards its outer side below. Bowel is never placed in front of a splenic tumour.

2. There is no line of resonance between the kidney dulness and the vertebral spines ; and no space between the kidney and the spinal groove, into which the fingers can be dipped with but little resistance, as there is between the spleen and the spine.

3. Renal tumours do not project backwards to any marked extent. They may cause a little fulness ; but, as a rule, they only efface the natural hollow of the loin. Tumours due to disease of the kidney enlarge in front.

4. The kidney is rounded in every part of its surface and marginal contour, and a renal tumour, whether solid or cystic, partakes of this distinctive feature.

5. Renal tumours are influenced to only a comparatively slight extent by the respiratory movements.

6. When the pelvis of the kidney is dilated the resulting tumour may press upon the liver, so as to be indistinguishable from it ; it may, and often does, reach down into the iliac fossa, and occasionally extends beyond the linea alba. As a rule, however,

renal tumours never invade the pelvis, and they are frequently separated from the hepatic dulness by a resonant area.

7. When the tumour is large enough to reach the front wall of the abdomen, the most anterior point at which it comes in contact with it is commonly about the level of the umbilicus, or a little higher; the lateral wall between the costal margin and crest of the ilium is then also bulged outwards.

8. A large varicocele of the left side, which would not occur in a case of splenic enlargement, has been met with in the case of a large tumour of the left kidney. This, which increased with the growth of the swelling, was directly due to distortion and distension of the spermatic vein.

Diagnosis of renal tumours. — 1. *Hepatic tumours* pass downwards from beneath the ribs, and so rarely have any intestine in front of them, that the presence of bowel in front of a tumour may be regarded as *almost* a sure sign that the tumour has not its origin in the liver. The sharp edge of a tumour of the right side, accompanied by symptoms of jaundice, exclude the probability of its renal nature.

2. *Enlargements of the spleen.*—Splenic tumours are movable; renal tumours are not usually so. The enlarged spleen has no bowel in front of it, and generally presents a sharp or well-defined edge, sometimes notched, beneath which the fingers can be passed. The tumour is traceable upwards beneath the ribs.

3. *Tumours of the suprarenal capsule.*—These are rarely large enough to give rise to a noticeable abdominal swelling, and when they do form an appreciable tumour it is almost impossible to distinguish it from a renal growth.

4. *Ovarian tumours.*—The bowel lies behind an ovarian tumour; both loins are resonant; the tumour

grows from below, is generally more central, and either drags up the uterus or can be felt as a swelling in the pelvis on vaginal or rectal examination.

5. *Enlargement of the lymphatic glands.*—The diagnosis from renal tumour may sometimes be made by the independent enlargement of one or more of the lumbar glands not forming part of the tumour; by the abruptness of the outline; and perhaps a protrusion of the growth along the spermatic cord into the scrotum.

6. *Flatulent or fæcal accumulations* in the cæcum and colon give rise to intestinal trouble, abdominal pain and colic, which, as a rule, render their diagnosis from tumours of the kidney easy.

7. *Fæcal abscess*, *perityphlitis*, or inflammation around the sigmoid flexure, will be distinguished by febrile disturbance, tenderness over the front of the affected part, and intestinal symptoms.

Cysts of the Kidney.

1. The numerous small **cysts of granular kidneys** never give rise to tumours, and are not amenable to surgical treatment.

2. **Conglomerate cysts,** or cystic metamorphosis of the kidney, is sometimes congenital, sometimes found in adults. The kidneys thus affected are occasionally of great size, and present themselves as abdominal swellings.

3. **Dermoid cysts.**—These only occur in animals.

4. **Simple serous cysts.**—These, which are frequently seen in the kidneys of old people, may attain such a size as to constitute a disease of great importance. They cause no symptoms except those due to their size; probably not one-fourth of them reach a size large enough to attract attention; and not one-third could be detected if carefully sought for by palpation.

These cysts arise in the cortex of the organ, and project in relief from its surface, the rest of the kidney being functionally active and healthy unless it be granular, or atrophied from the pressure of the cyst itself. The contents of these cysts are fluid, containing a small quantity of albumen and a little saline matter.

They commence insidiously, and grow slowly, gradually monopolising, as they increase, the greater part of the abdominal cavity.

Hæmorrhage may take place into them, and cancer has been developed in their parietes.

Treatment of serous cysts.—As soon as they attain an inconvenient size they should be tapped. If the cyst repeatedly refills, it should be cut down upon, and after it has been evacuated it should be cut into, and the edges stitched to the margins of the parietal wound.

5. **Hydatids of the Kidney.** — These are comparatively rare. The left kidney is nearly twice as frequently affected as the right. The cyst may be subcapsular, or lodged deeply in the substance of the organ. It forms an elastic, rounded, and sometimes fluctuating tumour, projecting from the surface of the kidney. The whole kidney may be ultimately destroyed by the cyst; in other cases the tumour remains quite small. A renal hydatid may burst into the pelvis of the kidney or into the intestine or lung. It may inflame and suppurate.

Symptoms.—In many instances these are absent. In some cases there are no symptoms until the cyst bursts, when attacks of renal colic begin. Sometimes there is an abdominal tumour, with or without the symptoms excited by the escape of the contents of the cyst along the urinary passages. Fluctuation is not always to be detected. The hydatids discharged *per urethram* are in various states, broken or entire. When the parent cyst has suppurated before bursting, pus is discharged as well as hydatids. Blood sometimes escapes. The escape of the vesicles may, or may not, excite nephritic colic. Should suppuration occur, then rigors, fever, and increased pain and tension about the tumour set in.

Prognosis.—This is not always unfavourable; the duration of the disease is uncertain, but often very prolonged. There is no fatal case on record where the vesicles have escaped *per urethram* from a renal hydatid cyst, which has *not* given rise to an abdominal tumour. When the cyst ruptures into the pleura or bronchi the probability of recovery is not good; but when into the stomach or bowels the chances are more favourable.

Treatment.—When the tumour increases without discharging *per urethram*, the only proper plan is to treat it in the same manner as described as appropriate for simple serous cysts which require surgical interference. It should be opened from the loin if possible; if not, then at its most prominent point.

OPERATIONS ON THE KIDNEY.

Besides the use of the trocar or aspirator, there are four surgical operations on the kidney, viz. nephrotomy, nephro-lithotomy, nephrorraphy, and nephrectomy.

Puncturing the kidney with a trocar or the aspirator is performed for the relief or cure of hydro- and pyo-nephrosis, large isolated serous or blood cysts of the substance of the kidney, and hydatid cysts. When, from their degree of distension, such swellings cause serious consequences by pressure, or there is risk of the cyst wall rupturing, the contents ought to be evacuated.

The point selected for puncturing will depend on circumstances. If there be any spot over the swelling which is thin, soft, prominent, or fluctuating, the trocar should there be inserted. When no particular spot is suggested, the best place is, on the left side, an inch in front of the last intercostal space. The place of selection on the right side is the ilio-costal space two and a half inches behind the anterior superior spine of the ilium.

Nephrotomy is an operation of very ancient date. It is performed for hydro-nephrosis when the cyst refills rapidly after having been punctured, and in cases in which simple puncture is inappropriate; for hydatid cysts under similar circumstances, or when, from the number and size of the daughter cysts, its contents cannot be evacuated through a small tube; for pyo-nephrosis, and for any case in which the kidney has been converted into an abscess sac, whether from the presence of calculus or tubercle.

The incision is precisely the same as for lumbar colotomy, except that as the kidney is situated a little nearer the median line than the colon, the deep part of the wound should be kept a little posterior to that employed in colotomy. When the kidney is reached, the distended pelvis, cyst, or abscess (as the case may be) should be either first tapped or at once cut into, its contents evacuated, and the cavity well irrigated with some disinfecting solution. If it be thought desirable (as in hydro-nephrosis and cysts of the kidney it is) to stitch the cut edges of the cyst to the edges of the skin, this should now be done. Four or five sutures will be ample for this purpose. A drainage tube should be inserted into the cyst, and the greater part of the wound left to granulate, though the anterior extremity of the parietal incision may be brought together by one or more sutures with advantage.

Nephro-lithotomy consists of cutting into the kidney for the extraction of a calculus. An incision is made four and a half inches in length parallel with and three-quarters of an inch below the last rib. If the quadratus lumborum be so wide as to contract the deep part of the wound, its outer edge may be incised to the extent of half or three-quarters of an inch. All bleeding vessels having been twisted, and hæmorrhage quite stayed, the assistant should stretch the edges of the wound widely apart with suitable retractors, and the operator with two pairs of dissecting forceps should then tear through the perirenal fat.

When the kidney has been fairly reached, the index finger should be passed carefully over the whole of the posterior surface of the organ, including its pelvis, and any inequality of surface, or increased hardness, or resistance at any particular spot, should be searched for. During this tactile exploration, indeed throughout the whole of the examination of the kidney, the abdominal walls of the patient should be well supported by an assistant, or by well-arranged pillows, so that the kidney should not be pushed forwards by the exploring finger. If nothing suggestive of the presence of a stone is thus felt, the anterior surface should be explored and the kidney should be pressed backwards by the finger which is feeling over its front surface. Next, if needful, the kidney should be freely exposed to view by drawing aside the edges of the wound, and a fine needle should be passed into the renal substance. This should be done in a systematic way, and at several places if the stone be not at once struck, introducing the needle here and there, so as to puncture in succession the several calyces of the kidney, in one or other of which experience tells us the stone usually rests.

Finally, if requisite, an incision may be made into the calyces, and the interior of the kidney examined by the finger tip, or with a probe.

Having detected the stone by one or other of the methods above described, it can be removed with a scooping movement of the finger introduced through the incision. Or a pair of forceps might be passed into the kidney by the side of the knife, and the stone seized and withdrawn. The finger is, however, much to be preferred, and if the incision is small, as it ought to be, the finger serves the purpose of plugging the renal wound, whilst it lacerates the renal tissue to the necessary extent. By this plan the hæmorrhage at the operation is minimised, and the rent made with the finger heals as rapidly as a cut.

The after-treatment is very simple; a drainage tube should be left in the back part of the wound, and the rest should be closed by sutures. For a time, of course, the whole or greater part of the urine secreted by the injured kidney will be discharged through the loin, but after gradually diminishing this may be expected to cease altogether in from three to four weeks. In some cases it has ceased on the second or third day.

The dressings will require frequent changing, as they soon become saturated with the urine. To keep the bedding dry, a large pad of finely powdered German moss peat should be placed beneath the loin to receive and absorb the urine, which it readily does.

Nephrorraphy is practised in cases of floating, movable, or wandering kidney, in which the organ, besides being mobile, is the seat of frequent, severe, and spasmodic attacks of pain, or of more or less continuous suffering. It consists in fixing the kidney in the loin, and is performed by exposing the organ by an incision, such as that described for nephrotomy or nephro-lithotomy. This done, a strong catgut suture should be passed through the renal capsule and the edge of the parietal wound. By tightening and knotting the suture the kidney is fixed back against the lumbar parietes. The wound should be stuffed with carbolised gauze or boracic lint, and left to heal by granulations.

Nephrectomy, or the removal of the kidney, may be performed by the lumbar or the abdominal method.

The advantages of the lumbar operation are twofold: (1) the peritoneum is not opened, and (2) the wound permits of excellent drainage. It is performed most easily by the transverse or slightly oblique incision, as in nephrotomy, made somewhat nearer the last rib than in lumbar colotomy; with this should be conjoined a second incision, running vertically downwards from the first, and starting from it about one inch in front of its posterior extremity. In making the first incision, which should be about four and a half inches in length, the operator must not go nearer than half an inch of the twelfth rib, for fear of wounding the pleura, which sometimes descends a little below it. The second incision may be left until the kidney has been reached and explored, and it can then be made by cutting from within outwards with a probe-ended bistoury, steadied by the index finger of the left hand. One great advantage of the vertical incision is the increased facility it affords for passing the ligatures around the pedicle. Other incisions have, however, been successfully employed.

The kidney being reached, the next step is to separate it from its surroundings. When no circumrenal inflammation has existed, the colon, peritoneum, and fatty tissue will easily be detached from their connection with the kidney by the index finger of one hand worked close against the capsule of the organ. It will generally, I think, be found that even when no inflammation has occurred, some of the renal capsule will be torn off and left behind; in other cases, as when the operation is performed for calculous or scrofulous pyo-nephrosis, and as a subsequent proceeding to nephrotomy, the kidney should be enucleated from its thickened and adherent capsule, and the latter left behind with the pedicle. The next step is to pass a double ligature of plaited silk through the pedicle, between the ureter and the vessels. This is done by means of an aneurism needle, fixed in a long handle, whilst the kidney is dragged well up into the wound by the left hand of the operator, one of the fingers of which can at the same time be acting as a guide for the needle. The needle passed and withdrawn, the ligature silk should be divided, and one-half of it should be tied tightly around the vessels and the other half around the ureter. In doing this the ligatures should be pressed well inwards towards the front of the spine, so as to leave plenty of room between them and the hilus for dividing the pedicle. The kidney should now be drawn quite out of the wound, a proceeding which is sometimes very difficult, but which will be greatly facilitated by dragging the lower ribs forcibly upwards with the fingers of the left hand dipped into the wound.* Another ligature should be thrown round the whole of the pedicle, and securely and tightly tied before cutting the kidney free, which is now safely done by snipping through the ureter and vessels with a pair of blunt-ended scissors.

Any bleeding points should at once be seized and ligatured or twisted. All the ligatures should be cut off short, and the pedicle dropped into the wound. A drainage tube should be fixed in the wound, the edges brought together with waxed silk or fishing-gut sutures, and the form of dressing commonly employed for fresh wounds by the particular operator should be applied. The patient should be kept in the recumbent position until healing is complete, and the drainage should be kept up for four or five days. Some surgeons attach importance to the separate ligature of the artery, vein, and ureter; others, again, think it is unnecessary to ligature the ureter; and others that the ureter had best be stitched to the external wound. The most important thing, however, is to securely control the vessels without putting too great a strain upon them in doing so.

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* I would lay special emphasis on this point, as being of much assistance in this step of the operation. Care should, however, be taken not to force the tips of the fingers through the diaphragm, as I believe has been carelessly done.

Abdominal nephrectomy should be performed in cases unsuited to the lumbar method. The best incision is that along the outer border of the rectus abdominis on the side of the kidney to be removed. The mid-point of the incision will probably be on a level with the umbilicus, but this must entirely depend upon the size and outline of the tumour.

All bleeding, which is sometimes considerable in this incision, having been stopped, and the peritoneal cavity opened, the state of the opposite kidney can be ascertained, if need be, by digital examination. The intestines should be kept aside from off the surface of the kidney to be removed by means of a large flat sponge introduced into the abdomen. The outer layer of the mesocolon should then be opened sufficiently to allow of the introduction of two or three fingers behind the peritoneum and into the fat in front of the kidney; the fingers should then gently tease their way towards the renal vessels, around which ligatures should be secured. If the vessels are tied separately, care should be taken to secure the artery before the vein. The ureter should then be seized by two pairs of ovariotomy forceps and divided between them. Langenbach's object in selecting this incision was to divide the outer layer of the mesocolon, and so avoid risk of hæmorrhage; this is more particularly necessary on the right side, since the inner layer of the mesocolon covers the vessel passing to the ascending colon. The enucleation of the tumour should next be proceeded with; lastly, the vessels should be divided outside the ligatures, and the mass removed from the body. The ureter should now be tied with ligature silk, like the vessels. Abdominal nephrectomy is completed like ovariotomy, and the subsequent treatment is the same.

Though in some cases, from size of tumour, the abdominal operation is easier, and therefore safer, the lumbar method is, as a rule, much safer, and to be preferred in all cases where the kidney is not much enlarged, where the tumour can be reduced by puncture, and when the loin space is not too much contracted.

Ureterotomy is the incision of the ureter. It has been suggested that when a calculus is blocking the ureter, the calculus should be removed either by abdominal section, and subsequently closing the incision of the ureter by continuous suture; or by an incision from the bladder when the calculus is impacted at the vesical orifice of the ureter.

XIII. INJURIES AND DISEASES OF THE BLADDER, PROSTATE, AND URETHRA.

C. Mansell Moullin.

Wounds of the Bladder.

The bladder may be injured by stabs or gun-shot wounds through the abdominal wall, or even through the sacro-sciatic foramen, through the rectum, vagina, or urethra, and by the pelvic bones in cases of fracture. The part covered by the peritoneum may be involved (so that the urine enters into the peritoneal cavity) or the anterior surface and the base. In the latter case the urine either becomes extravasated into the cellular tissue, and causes sloughing, or escapes by the rectum or vagina, leaving a fistulous channel.

Gun-shot injuries are not so fatal as might have been expected; the urine escapes externally through the wound made by the bullet, and its retention and decomposition are thereby prevented. The same occurs when the bladder is wounded by foreign bodies pushed into it through the rectum or vagina, or when, in consequence of pressure during parturition, the septum sloughs and gives way. When there is no external wound affording an easy exit for the urine, it accumulates, decomposes, and acts as a most virulent septic poison.

Symptoms and **treatment.** (*See* Rupture.)

Rupture of the Bladder.

This can only occur when it is distended. If it is healthy, and the urethra free, it cannot happen without external violence, such as a blow over the pubes, or sudden compression of the abdomen. But if there is an insurmountable obstacle to the flow of urine, as occasionally happens in child-birth (though here the rent is oftener due to bruising and sloughing), or if the bladder is in a state of advanced cystitis, with its walls thinned, sacculated, and even ulcerated, the simple contraction of the abdominal muscles is sufficient. Under circumstances such as these the effort of straining at stool, or attempting to lift a weight, may cause an extensive rent.

The rupture may be **intraperitoneal** or **extraperitoneal.** If there is antecedent cystitis the weakest spot gives way, wherever it may be, and the opening is more or less circular, with sloughing and everted edges; but if the bladder is healthy, and the violence sudden and external, it is most common for it to extend from one to three inches along the upper part of the posterior wall from the urachus vertically downwards. In this case it partakes of the nature of a lacerated wound.

The typical primary *symptoms* of rupture are a feeling of something giving way, pain, shock, inability to stand or walk, desire, but want of power, to micturate, and removal from the bladder with the catheter of blood only, or a small quantity of bloody urine. The deficiency of urine, and loss of power to micturate often continue throughout. In intoxication this accident is peculiarly liable to happen from the distension of the bladder, and the absence of the protecting contraction of the abdominal muscles; but every symptom may remain in abeyance for hours. In general the pain and collapse are intense, there is the most urgent desire to pass urine without being able to void any, and peritonitis rapidly ensues.

1. **Intraperitoneal rupture.**—Immediately after the accident the bladder collapses, the urine enters the peritoneal cavity, and the intestines fall

down on to the surface of the rupture. The object of the *treatment* is first to free the peritoneal cavity of the urine that has already entered it; secondly, to prevent the entry of any more.

In rare instances the peritoneum shows itself remarkably tolerant of urine so long as it is healthy, and, above all, aseptic. But it does not do to rely on this. It is much safer to make an incision in the middle line of the abdomen under antiseptic precautions, and carefully sponge the pelvis out.

The other indication is more difficult. Sewing up the rent has been practised, but it is doubtful how far this is necessary if a free drain is provided through the perinæum. When the bladder collapses the rent contracts very much; its sides are more or less valvular, owing to the alteration in the relative position of the mucous membrane and the muscular coat; the small intestines soon become glued to the edges; very little urine is secreted at first, and stitching the bladder requires an immense amount of manipulation. But free drainage is essential. This cannot be done effectually by catheters. The bladder must be opened either by the lateral or the median method of cystotomy; a tube must be introduced and kept open so that every drop of urine as it falls into the bladder may escape at once. It is conceivable that in this way the wound in the bladder may heal, having perfect rest, and that if peritonitis does not come on from the urine that has already escaped, the patient may recover. But the prognosis is very unfavourable.

2. **Extraperitoneal rupture.**—When the rupture of the bladder involves the extraperitoneal part, the same general line of *treatment* must be followed: there must be free exit for the urine that has already escaped, and no more must be allowed to accumulate in the bladder. As a rule, incisions are required in the suprapubic region.

The general treatment of such accidents is the same as that for acute traumatic peritonitis. Opium should be given freely; food of every kind withheld for twenty-four hours; the thirst allayed by allowing the patient to suck fragments of ice, while the body is kept fairly warm and absolutely quiet.

TUMOURS OF THE BLADDER.

Tumours of the bladder have a tendency to assume a polypoid or villous character, even when they are malignant. Two explanations have been suggested for this: one that it is due to the alteration in the support they receive when the bladder is full and when it is contracting; the other that it is an inherent peculiarity connected with the development of the bladder from the allantois (Fig. 47).

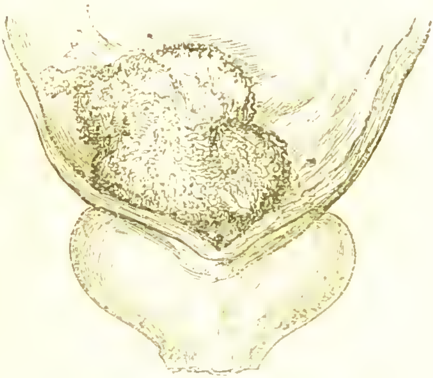

Fig. 47.—Villous Sarcoma of Bladder. (Middlesex Hosp. Museum.)

Varieties.—They are either simple or malignant. The former include papillomata, mucous polypi, fibromata, and, as a great exception, myomata. The latter carcinoma and sarcoma.

Papillomata are generally single and sessile, but they may be multiple or pedunculated. The most common form is a circumscribed tumour covered over with villi projecting from the surface of the mucous membrane and freely movable. More rarely there is a shaggy villous coating to the whole interior. In structure they consist merely of delicate connective tissue, containing loops of vessels covered with a prolongation of the vesical epithelium. The mucous membrane round them is perfectly healthy, and the growth does not involve the deeper-lying strata. The trigone seems to be a favourite situation for these, and, indeed, for all tumours of the bladder.

Mucous and fibrous polypi are much more rare. The former may be multiple, and resemble in character the polypi found in the lower part of the nasal fossæ. The latter are true fibroid tumours which have become pedunculated.

Sarcoma is not common, but certain tumours are occasionally met with, to which the name "transitional" has been applied, as they present features to some extent intermediate between papilloma and sarcoma.

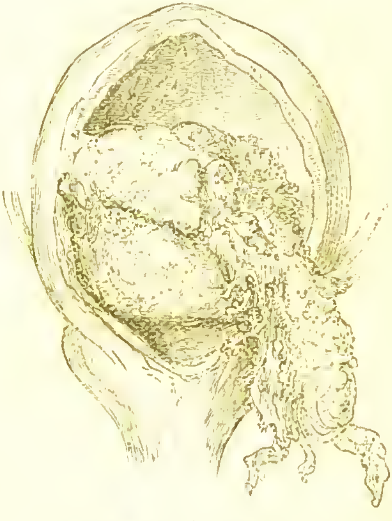

Fig. 48.—Epithelial Cancer of the Bladder. (Middlesex Hosp. Museum.)

Carcinoma of the bladder may be either epithelial or encephaloid. Scirrhus has been described, but is very rare. The character of the growth is essentially the same, the chief differences being in the relative amount of stroma present and the shape of the cancer cells, which, in correspondence with the epithelium of the bladder, may be squamous, polyhedral, or columnar. Ulceration sets in early, and often (as, indeed, sometimes happens with villous tumour) a coating of phosphates forms on the top, so that they feel like adherent phosphatic calculi.

Epithelioma is most common in the trigone, but it is never limited to the mucous membrane. Malignant tumours may always be distinguished, even though they are covered over with villi, by the way in which they infiltrate the neighbouring tissues, both at the margin and at the base (Fig. 48).

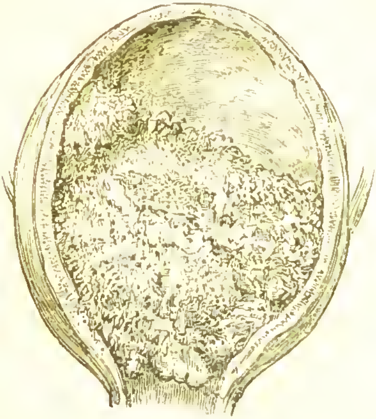

Fig. 49.—Extensive Villous Growths from the Bladder. (Middlesex Hosp. Museum.)

The symptoms of tumours of the bladder are hæmaturia, cystitis, and pain.

Both benign and malignant growths cause hæmorrhage, especially after micturition, owing to the sudden relief of pressure, and whenever a catheter is passed. If it occurs in young patients, and is only occasional, particularly if it is very profuse, and continues off and on for years, the growth is most probably a papilloma.

The pain may be merely due to the cystitis, but in carcinoma there is not unfrequently a constant aching sensation in the loins and down the thighs. The cystitis depends upon the interference with the function of the bladder and the retention of urine. It may be very long in making its appearance, this depending probably on the exact position of the growth; but when it has once commenced it persists, and adds very seriously to the patient's discomfort.

The **diagnosis** must be made from the symptoms or from the presence in the urine of fragments that can be identified as portions of villi or of epithelial carcinoma. If the passage of a catheter is constantly attended by profuse hæmaturia, it is sometimes possible to extract a fragment of the growth by using an instrument with a large eye, and allowing the urine to stream out rapidly through it. In exceptional cases portions may be withdrawn with a flat-bladed lithotrite. But, as a rule, the diagnosis can only be confirmed by digital exploration. The urethra in the female may be dilated easily under an anæsthetic, so that when firm pressure is made in the suprapubic region, the finger can explore the whole interior of the bladder. In the male the same can be done (if the perinæum is not very deep) by opening the membranous part of the urethra in the middle line. In this way, the size, shape, number, and, to some extent, the nature of the growth may be ascertained, so that the adoption of further measures may be considered.

Prognosis.—The hæmaturia rarely proves fatal of itself, though it is of serious moment from the way in which it reduces the patient's strength. In old cases the cystitis becomes extreme, and is followed by the ordinary complications, atony, retention, pyelitis, and surgical kidney. If the growth is malignant, nothing can be done beyond relieving the symptoms of the time. Excision of a portion of the wall has been practised with success in the case of animals, but could only be of service in quite exceptional circumstances.

Treatment.—In recent years many attempts have been made, and with complete success, to remove non-malignant growths from the interior of the bladder. In the case of women this can be done most easily through the urethra, by means of properly contrived forceps which have the serrated crushing edge guarded by projecting wings, so that they may seize the root of the growth and crush it off without injuring the mucous membrane. In men it may be accomplished through an opening in the perinæum or over the pubes. The former has the advantage of draining the bladder more thoroughly after the operation; the latter of giving a larger amount of room and more free movement. Probably each operation is suited to certain particular cases; the perineal one, where it is necessary first to perform an exploratory operation, or where the growth is attached to the trigone; the suprapubic under other circumstances. In certain cases it has been found advisable to make use of both together. If the growth is pedunculated it may be seized with forceps and crushed or twisted off; where it is sessile much may be accomplished by freely removing all the superficial parts so that the subsequent cicatrix may obliterate the rest. Even when it is multiple, great relief has been obtained by scraping off small sessile growths with the finger nail. In very rare instances the growth has been extruded through the urethra or through the wound (according to the sex), ligatured, and cut off.

EXTROVERSION OF THE BLADDER; ECTOPION.

Absence of the anterior wall of the bladder, with more or less deficiency in the corresponding part of the abdomen, involving even the symphysis pubis and the upper part of the penis. It is more common in males than females, and is due to the defective formation of the mesoblast in the body wall behind the umbilicus. At birth, the deficiency is made up by a thin membrane which dries up and is cast off.

Appearance.—The posterior wall of the bladder is exposed with the orifices of the ureters. Owing to the pressure of the viscera behind, it is gradually pushed forward until it projects as a rounded tumour above the pubes covered with mucous membrane, which, from the constant exposure and friction, becomes vascular, red, and ulcerated (Fig. 50). The urine continually drains away, so that the condition of the patient is most distressing unless something can be managed in the way of a contrivance. The most efficient is a concave shield, fitting closely to the skin round the projection, and connected below with a urinal; but even this is rarely satisfactory.

Treatment.—The measures that have been devised to relieve this distressing deformity aim at either diverting the course of the ureters into the colon, or closing the gap, with the exception of the lower angle, by means of plastic operations. The former is very rarely successful: the latter may give considerable relief, but repeated operations are generally necessary.

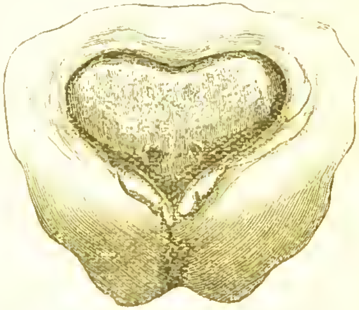

Fig. 50.—Ectopion Vesicæ. The posterior wall of the bladder with the openings of the two ureters is to be seen.

The operation consists in dissecting up flaps of skin, and replacing them over the orifice (the edges of which have been freshened), so that there shall be a double layer: one, the deeper, with its cutaneous surface towards the cavity; the other facing the opposite way, so that the raw surfaces of the two may be in contact. The deep flap may be dissected up from the abdomen above the cavity, and turned on itself downwards; or if the gap is not very great, it may be formed from the groin with a long neck, and then twisted on itself so as to be adjusted in the same way. The superficial ones are either formed from the lateral portions of the abdomen, on either side of the deficiency, and brought over the reflected flap to meet in the middle line ; or when the deep flap is fashioned from one groin, the superficial one is taken from the other and adjusted over it.

The flaps must be very carefully fitted to the freshened margins, and should be braced firmly together by means of hare-lip pins. Afterwards, broad strips of plaister are brought over the abdomen to relieve the tension as much as possible, and the patient is kept quiet in bed, with the knees flexed and tied together.

Union rarely takes place everywhere, small fistulous channels being left, through which urine continues to drain away, and requiring further operations. Even then the orifice, at the inferior angle, continues to yield, and it is generally necessary to perform some further operation to rectify the epispadias.

CYSTITIS.

Cystitis is either acute or chronic, though no hard and fast line can be drawn between them.

Acute cystitis is generally due to injury, whether mechanical, from instruments, calculi, or foreign bodies, or chemical, that is to say, from urine either putrid or containing cantharides or excess of uric acid. It is sometimes caused by an extension from neighbouring parts, the urethra or peritoneum. Cold is an exceptional cause even in gouty subjects.

The *appearances* differ according to the severity. There may be merely hyperæmic swelling and softening of the mucous membrane, with an increase in the amount of the mucus and epithelium thrown off ; or the congestion may be intense, with blood escaping into the interior or into the walls, so that they become stained and ecchymosed. The epithelium undergoes mucoid softening ; the surface is raw and ulcerated, or covered with shreds of lymph; and the exudation that is poured out collects as pus in the urine, or forms a firm fibrinous coating (like a diphtheritic membrane) on the interior, or is heaped up in the submucous and muscular tissues until they are riddled with abscesses.

The *symptoms* are (1) constitutional, and (2) local. The former vary from fever of the utmost severity (the patient sinking rapidly into a hopeless typhoid state), to a mere transient pyrexia. The latter are thoroughly characteristic. The bladder is inflamed and irritated; the contact of the urine excites it to such violent spasmodic contraction, that as soon as a few drops collect they are expelled at once; intense burning pain is felt in the perinæum; pressure over the pubes makes it infinitely worse; and the urine is scanty, high coloured, mixed with shreds of mucus, and in severe cases with blood. Gonorrhœal cystitis is generally subacute, and limited to the neck of the bladder.

Prognosis.—The inflammation either subsides when the cause is removed, or else becomes chronic. If it is due to septic causes, especially if the acute attack is grafted on a chronic one, suppuration may set in; the septic influence travels up the ureters and causes acute nephritis, or peritonitis follows from extension through the walls of the bladder, or the urine becomes infiltrated into the tissues, and causes sloughing.

Treatment.—If the bladder and kidneys are healthy, and the cause is only temporary, the inflammation soon subsides. The urine may be rendered less irritating by the use of henbane, alkalies, or alkaline carbonates; morphia suppositories should be given at night to relieve the stranguary; leeches should be applied to the perinæum, and the bleeding should be encouraged by poultices. The patient should be kept warm in bed; should be given a hot hip bath night and morning;

should have his bowels kept open, and be put on a mild, unstimulating diet, with plenty to drink.

If the urine is ammoniacal (particularly if the kidneys and bladder were previously diseased), the condition is very different. So long as the bladder is allowed to retain putrid fluid the inflammation must continue, and even if acute nephritis does not set in, the patient is poisoned by the absorption of septic matter. The bladder must be washed out with antiseptic solutions to check decomposition; or if this fails, an incision must be made in the perinæum and the putrid fluid allowed to run off as soon as it enters the bladder. Sometimes this succeeds, but more often the patient sinks from septic intoxication and renal disease.

Chronic cystitis is the result of the acute form, or follows from the same agencies when they are less severe and more persistent. Everything that interferes with the function of the bladder, that prevents it emptying itself thoroughly, or that sets up a condition of tension, irritates it and brings on an attack of inflammation, which, when the exciting cause is continuous, persists. New growths in the bladder (though many of these, tubercle, for example, are accompanied by inflammation under all circumstances), stricture, enlarged prostate, atony, paralysis from disease or injury of the spine, all tend to excite it.

A larger quantity of alkaline mucus is thrown out; this mixing with the urine retained at the base of the bladder lessens its acidity. Decomposition is thus rendered more easy. A ferment gains access in some way, either through a catheter (for it has been known to occur within two days after the first introduction of an instrument), or by gradual extension upwards in the mucus lining the urethra; the urea splits up; the urine becomes fœtid and ammoniacal, and the cystitis is permanent.

Diagnosis.—Renal calculus and tuberculous pyelitis sometimes simulate cystitis very closely; and cystitis must be distinguished from irritability of the bladder due to other causes, such as (in women) a vascular tumour of the urethra, congestion or displacement of the uterus, prolapse of the wall of the vagina, or even hæmorrhoids and other affections of the rectum.

Pathological changes.—When slight there is only hyperæmia and an increase in the secretion of the mucous membrane. When more severe, the interior is rough and irregular, stained slate colour from old hæmorrhages, with red or purple patches here and there from more recent ones, and darker lines corresponding to tortuous and dilated veins. It may be ulcerated, or, especially on the ridges, coated over with a fœtid mixture of pus and phosphates. The submucous tissue is infiltrated, hardened in some places, and full of small abscesses in others.

The ulceration is extensive where the exciting cause is tubercle or septic matter, acting on a bladder already diseased. If it is due to stone it is generally limited to the neck.

If the obstruction has come on slowly, and the bladder has worked long to overcome it, the muscular coat is irregularly hypertrophied so that the interior is thrown into ridges, separated by depressions, which in old cases become deeper and deeper until they form outlying pouches with narrow necks (Fig. 51). In these urine accumulates and decomposes, so that sometimes they are filled with phosphatic concretions. If, on the other hand, the obstruction has been sudden and extreme, the muscular wall is overstretched, thinned, and atrophied.

The *symptoms* are those of acute cystitis, but much less severe. Pyrexia may be almost absent, but the constant pain, the want of rest, and, above all, the interference with the function of the kidneys, rapidly undermine the health.

Pain is felt in the perinæum and over the pubes, becoming more acute as the bladder is distended and when it contracts, ceasing when it is empty. There is a constant burning sensation at the neck of the bladder, and an almost irresistible desire to pass water, it may be every minute. The urine is ejected spasmodically; it may be acid, with, as in gonorrhœal cystitis, merely a floating cloud of mucus; or alkaline, ammoniacal, and fœtid; or turbid, with phosphates and pus, and, if left to stand, separating into two strata, an upper, moderately clear, and a lower, which consists of a slimy, gelatinous mass, adhering to the vessel as it is inverted, and then suddenly slipping out.

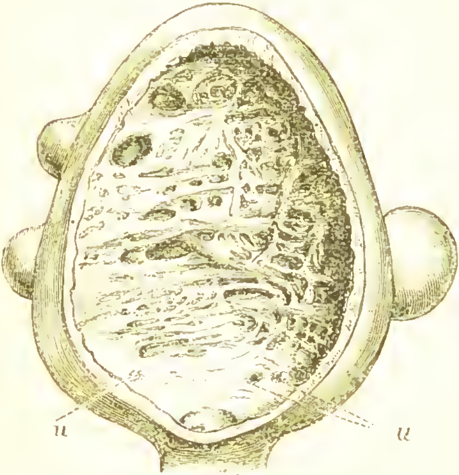

Fig. 51.—Hypertrophied and Sacculated Bladder. (Middlesex Hosp. Museum.) u, Orifice of ureter. Double on left side.

When the local pain is very severe, and blood is constantly present, ulceration of the mucous membrane may be diagnosed.

Treatment of chronic cystitis.—The constitutional treatment of chronic cystitis is the same as that of acute. Rest and warmth are essential; the diet should be light and without stimulants; milk by itself for a time is often of great service; the bowels should be kept freely open, and irritation should be relieved by morphia and belladonna suppositories or henbane. Where there is a profuse secretion of mucus, without the urine being ammoniacal, copaiba and other balsams may be given with benefit, or infusions of triticum repens, buchu or uva ursi in large quantities. Alkalies, even when the urine in the bladder is alkaline, sometimes allay the irritation, possibly because it is too acid when secreted by the kidneys. Benzoic acid and benzoate of ammonia have a tendency to increase the acidity, and so check decomposition.

General treatment is of no use so long as the local cause persists. If this can be removed, the urine, even when it is ammoniacal, often recovers of itself. When it cannot be done the decomposition of the urine must be checked by other means. The bladder must be washed out carefully night and morning. A saturated solution of boracic acid; four grains of iodoform suspended by mucilage in an ounce of water; or a solution of quinine gr. 1 ad ℥j, or very dilute bichloride of mercury may be used. But not more than two or three ounces should be injected at a time; the fluid should be of exact temperature, and it should be allowed to flow in and out by its own weight. Before injecting a medicated solution it is as well to wash out the deposit of mucus. If by this means decomposition has been stopped, but the catarrh continues, tincture of iodine or acetate of lead gr. ss ad ʒj, nitrate of silver gr. 1 ad ℥j, may be used as astringents in the same way, with mild counter-irritation applied to the perinæum.

As a final resource where the condition of the bladder resists all treatment, and the patient is tired out, *cystotomy* by the median perineal section may be tried. Sometimes, in this way, a cause that could not be detected by other means is found and removed, or, if not so successful as this, the bladder is given thorough rest and drainage, so that it sometimes recovers of itself.

RETENTION OF URINE.

Retention of urine may be due to **causes** acting on the urethra or the bladder.

1. Calculus or other foreign bodies impacted in the urethra.

2. Tumours, such as an enlarged and displaced uterus pressing on it from outside.

3. Alterations in the wall of the urethra, either permanent, as stricture and enlarged prostate, or temporary, as congestion and spasm. This is by far the most common.

It is very rare for any one of these to act entirely by itself; an impacted calculus occupies only part of the interior, but the hyperæmia and spasmodic contraction of the tissues round soon close the rest of the canal; and enlarged prostate may exist for years until some accidental congestion causes sufficient swelling of the mucous membrane.

4. The bladder itself may be unable to expel its contents, from various causes: atony of its walls; paralysis; hysteria; diseases of the spinal cord (*e.g.* locomotor ataxy); peritonitis; exhaustion, as in fevers; belladonna poisoning; alcoholic, or other excesses; or shock. In old people very little is needed; merely the passage of a catheter or a fall on the trochanter. In younger persons retention of urine is met with chiefly after operations about the rectum, injuries of the pelvis, and railway accidents.

Results.—As the bladder becomes filled, it rises up from the pelvis into the abdomen, and projects above the pubes as a rounded tumour, dull on percussion, and most prominent when the patient is standing. It may reach the umbilicus, or even the ensiform cartilage, so as to be mistaken for ovarian tumour, if its walls are thin and soft; but in old cases of cystitis, where there has been chronic retention for years, where the walls are rigid and hypertrophied, and the cavity is contracted, such distension is impossible, and there may be retention with urgent symptoms without the bladder being perceptible from the exterior.

The bladder itself rarely gives way ; its muscular fibres may be so stretched as to lose their power of contracting either for a time, or even permanently, so that it is left in a state of atony, unable to empty itself; but, unless some portion of the wall is exceedingly soft from fatty degeneration, or some additional compression is applied from the outside, rupture is quite unusual. It is far more common for the softened and ulcerated mucous membrane behind a stricture to tear, and give rise to extravasation. In the majority of instances the congestion and spasm which have, so to speak, been the last straw in closing the urethra, give way before the pressure, and the bladder remaining full, the urine flows away continuously drop by drop. This is the overflow of urine from a bladder that is too full, and is different in every respect from incontinence, in which the bladder is empty.

The **symptoms of complete retention** depend on its mode of onset, rapid or slow. In the former the pain is intense, and if relief is not soon afforded constitutional disturbance of a typhoid character sets in, the patient becoming delirious, the tongue dry and brown, and the pulse small and frequent. These symptoms depend probably on the sudden check offered to the secretion in the kidneys, with the exception of the local pain, which is due to the extreme and rapid distension of the bladder, and is even more severe when the cavity is small, and the walls rigid, than when it is of normal size and elasticity.

When retention comes on gradually, as in cases of stricture, the urinary organs have had time to adapt themselves to the altered conditions, and the immediate symptoms are not so urgent. It is even not uncommon to hear a patient suffering from stricture, with his bladder distended far above the pubes, complain of nothing more than the inconvenience caused by the incessant dribbling of urine. In this case there is no sudden check to the secretion of the kidney, but the ultimate result is no less grave, for the ureters dilate, and chronic pyelitis and surgical kidney inevitably follow.

The treatment of retention must be guided by a knowledge of the cause, but in all cases it is absolutely necessary to relieve the bladder as soon as possible.

When it is due to *atony* or loss of tone in the walls of the bladder (*see* Atony), a soft catheter must be passed with the utmost gentleness night and morning, at least, until the muscles have recovered. Or if a *calculus is impacted*, or the uterus is displaced so that it drags on the urethra, suitable means must be at once adopted to remove the obstruction. (*See* Impacted Calculus.) But where the cause is some change in the wall of the urethra, either permanent, as *stricture* and *enlarged prostate*, or merely temporary, as the congestion of gonorrhœa or acute prostatitis, it often happens that other expedients must be adopted to meet the exigencies of the moment.

When it is due to *congestion*, retention may come on suddenly, brought on immediately by exposure to cold or by alcoholic excesses, or may give a warning by the rapid diminution in the size of the stream. The bladder soon becomes distended, and, owing to the neck being involved, there is the most intense desire to micturate, with severe constitutional trouble and urgent distress. Relief must be given at once, or serious, perhaps even permanent, atony will result. A catheter should be passed immediately if the symptoms are urgent; but if the patient can wait for half an hour he may be placed in a hot bath (the temperature as high as can be borne, and maintained at that point) and given a full dose of opium, half a drachm to forty minims of the tincture. Sometimes, when there is much spasm, this of itself procures relief, or if not so successful, it makes it easier to pass a catheter afterwards, procures sleep and quiet, and tends to prevent the occurrence of rigors and other secondary troubles. The bowels must be thoroughly opened as soon as possible ; the urine rendered unirritating by the use of alkaline carbonates and sedatives, such as hyoscyamus ; all stimulants forbidden, and the patient confined to his bed, or at least his room. This treatment must be kept up for four or five days in a case of gonorrhœa, or until the abscess bursts, if the obstruction is due to suppuration in the prostate.

When the cause is *stricture* the immediate symptoms are rarely so severe. The constriction grows tighter and tighter by slow degrees, giving rise to difficulty, and causing the bladder to become hypertrophied ; but the obstruction is not complete until from some accidental cause, such as exposure to cold or alcoholic excesses, spasm and congestion are set up in addition. The treatment must be conducted on the same principles, only it is as well to be careful in the administration of opium, as the kidneys are frequently diseased. An attempt may be made to give relief at once by means of a catheter, using one of moderate size, unless the state of the stricture is known from previous experience ; then smaller and smaller ones may be tried, but always with the utmost gentleness ; force of any kind should never be used, and there should not be the slightest stain of blood. The more soft and flexible the instrument is, especially near the point, the more likely it is to be guided by the mucous membrane of the urethra into the orifice of the stricture. Black ones, slightly bulbous at the point, are the most useful, but they are very liable to break at the eyes; small metal ones are exceedingly dangerous. When these fail, a gum elastic or a catgut bougie may sometimes succeed, and the urine will almost certainly follow as it is withdrawn, but it is very questionable whether it is advisable in the majority of cases to persist long in this line of treatment. The way to overcome the obstruction is to irritate it as little as possible. It is better, if a catheter does not pass after a very moderate trial, to place the patient at once in a hot bath and give him a full dose of opium. This nearly always succeeds, and it will generally be found, if he is kept in bed, on light food, without stimulants, if the bowels are kept open freely, and if hot baths are given night and morning, that in a few days the spasm and congestion have disappeared so thoroughly that a catheter passes with ease. The only alternative is to give an anæsthetic, make a further attempt, and then, in case of failure, puncture the bladder. The result, so far as concerns the stricture, is the same, but at the expense of an operation.

When *enlargement of the prostate* is the cause, the circumstances are different. There is little or no spasm; the prostate portion is elongated and perhaps tortuous; its sides, which, like those of the rest of the urethra, are in contact with each other, are not easily (owing to the increase in size and density of the tissues round) forced apart when the stream begins to flow; the bladder loses some of its power, and then, from some accidental cause, congestion sets in, the mucous membrane swells up, and the narrowed channel is completely obstructed. Opium and hot baths can do no good, and often are positively dangerous. A catheter must be passed at once; either a silver one, with a long and sweeping curve, a gum elastic, with a stilet in as already described, or a black one, with the point bent up (coudée), so as to ride over the obstruction. Unless a stricture is present as well, the largest catheter that will pass the meatus should always be selected, and, owing to the growth of the prostate, it should be of extra length. Violence is never justifiable, but it is often necessary, when passing a catheter under these conditions, to make use of a certain amount of steady, but firm pressure. The urine is nearly always blood-stained for some days after, owing to the congested state of the mucous membrane at the neck of the bladder. If this treatment does not succeed, the choice lies between tapping the bladder or forcibly pushing the catheter through the substance of the prostate and tying it there.

Tapping the bladder may be performed either as a temporary measure to allow the spasm and congestion to subside, or when the urethra is obliterated to afford a permanent means of exit for the urine. In exceptional instances relief may be obtained by external urethrotomy, especially if it is wished at the same time to divide a stricture or open up the prostate; but in general the operation means opening the bladder either above the pubes or through the rectum.

In *suprapubic tapping* the bladder is entered below the fold of peritoneum through the anterior wall of the abdomen. There is abundant room for this when the bladder is thoroughly distended, but in cases of old cystitis, where it is rigid and unyielding, it is advisable to keep close to the posterior surface of the symphysis, and to introduce a dilator into the rectum. When temporary relief only is required the aspirator may be used, a small incision being made in the skin with a scalpel, and the trocar pushed through it into the bladder downwards and backwards. No extravasation follows the withdrawal of the canula, as the mucous membrane glides on the muscular coat when the bladder collapses, and the orifice at once becomes valvular. If necessary this may be repeated more than once.

When a more permanent opening is required, a large trocar (with a linear, not a triangular, cutting edge) and a canula should be introduced in the same way. On withdrawing the trocar a soft elastic catheter may be passed down the canula, and left in when this is removed. After a few days the tissues become consolidated round the opening, and there is a short straight canal leading into the bladder, which may be fitted up permanently with an indiarubber or silver tube provided with a stop-cock. Owing to the contraction of the sinus the amount of leakage round the tube is infinitesimal, and there is nothing to prevent this arrangement lasting for years.

In *tapping through the rectum* the patient is held by assistants in the lithotomy position, and brought well down to the edge of the bed. The fore-finger of the left hand is then introduced into the anus, and the boundaries of the prostate are examined. The finger should reach well above its upper border, and should be able to feel distinctly a wave of fluctuation when the anterior wall of the abdomen is percussed over the pubes. Then a long curved trocar and canula is taken, and the point, guarded by the finger, guided to the spot where fluctuation is felt, exactly in the middle line. This corresponds to the trigone of the bladder. When this is adjusted the handle is slightly depressed and driven smartly upwards and forwards in a direct line for the umbilicus. If it is wished to keep the opening patent either the canula or an elastic catheter must be left protruding from the anus. There is no doubt that in this way the bladder is drained much more efficiently than by either of the other methods, but it is not suited to cases of enlarged prostate, and as a permanent method it cannot be compared with suprapubic tapping. In many patients there is great difficulty in maintaining the canula or catheter in position even for twenty-four hours, owing to the irritability of the rectum. As a means of temporary relief it is as safe as suprapubic aspiration; there is very little fear of extravasation in either case, and one is as easy as the other; but while it is very successful if the patient is able to tolerate a tube in his rectum for some days, it has this disadvantage, that if he cannot a repetition of the operation is not advisable.

ATONY OF THE BLADDER.

The bladder is said to be in a state of atony when, the nervous mechanism being unaffected, its muscular power is so impaired that it is unable to empty itself. The retention may be complete, the bladder being unable to expel any of its contents; or partial, a certain residuum always being left behind, so that the available space in the bladder is considerably diminished. In the first case overflow is the prominent symptom; in the second, frequency of micturition.

When the retention is due to some affection of the nervous system, the bladder is said to be paralysed.

Causes.—Over-distension is the most common immediate cause of atony; it may be due to voluntary retention, to stricture, or enlarged prostate; and it may occur in a perfectly healthy bladder, the muscular fibres being so stretched that they are unable to recover themselves. But it is more often met with when the nutrition is already impaired by other causes; in old age, for example, the muscular coat of the bladder becomes feeble and undergoes a kind of senile atrophy, in common with the rest of the muscular system, so that stricture of the urethra gives rise to a dilated atonic bladder instead of one that is contracted and hypertrophied. In chronic cystitis, again, the same thing happens when the muscular coat is involved; it becomes infiltrated with dense fibroid tissue, and is neither able to contract nor expand as it should; or else, after some time, the compensative hypertrophy gives way to fatty degeneration. Under circumstances such as these a very slight additional cause, even the introduction of a catheter, may bring on complete retention, due in part to the nervous shock, in part to the atonic condition of the muscles.

The symptoms of atony are those of retention. It may be sudden and complete: the bladder becomes more and more full until something gives way. Or it may be gradual and partial, the bladder being unable to empty itself thoroughly. The former leads to what is sometimes called incontinence, the obstruction yielding, and the urine running away drop by drop, as it enters, leaving the bladder always full. The latter causes increased frequency of micturition, owing to the diminution in the capacity of the bladder. Cystitis, decomposition of urine, pyelitis, and surgical kidney are the invariable results of both, if the condition is left without remedy.

Treatment.—Atony, occurring in a healthy bladder as the result of over-distension on a single occasion, is sometimes incurable. Generally speaking, however, by giving the muscles perfect rest, drawing the urine off at frequent intervals, and by the use of tonics, especially when applied locally, the power gradually returns. Washing it out with cold water, care being taken not to induce cystitis; strychnia and nux vomica, either by the mouth or hypodermically, and galvanism (one pole in the rectum and the other over the lumbar spine) may also be tried.

When it is due to old age, fatty degeneration, or inflammation, the condition must be regarded as permanent. All that can be done is to postpone as long as possible the chronic cystitis and disease of the kidneys which are so prone to ensue. (*See* Enlarged prostate and Retention.)

INCONTINENCE OF URINE.

This condition must be clearly distinguished from overflow. In the one the bladder is unable to retain its contents; in the other it is over-full and unable to empty itself, so that the urine drains away.

Causes.—1. In adults, true incontinence may occur as the result of a very rare form of overgrowth of the prostate, which so interferes with the neck of the bladder that it is unable to act; and, still more rarely, from impacted calculus. It sometimes follows injuries or diseases of the spinal cord, when the lumbar enlargement is implicated, the bladder gradually diminishing in size and increasing in thickness until it is no longer able to act as a receptacle.

2. In children, particularly in male children, a form of incontinence is much more common. It occurs most frequently at night, and seems to be due rather to the control over the bladder being abolished by sleep than by anything else. Under these circumstances any irritation, however slight, applied to the urinary organs will cause micturition in accordance with the ordinary laws of reflex action. Stone, phimosis, elongated or adherent prepuce, worms, especially in the rectum, polypus, or irritating conditions of the urine, are sufficient to excite it. Even the pressure of the bed clothes and the position during sleep have some effect.

Treatment.—In many cases a definite cause can be found, and this, of course, must be removed; but often after this has been done, the habit persists, even against the will. Waking the child the last thing at night to make him pass water; light clothing in bed; making him lie on his side when asleep; avoiding late and heavy meals; cold sponging night and morning, with tonics and quinine, internally, frequently effect a cure. Nux vomica, cantharides, and belladonna are decidedly of service, especially the latter, which must, however, be pushed until it produces some of its physiological effects. In inveterate cases a solution of nitrate of silver has been applied to the neck of the bladder, sometimes with benefit. Galvanism, applied as for atony, is one of the most effectual remedies. The most obstinate cases, however, in general get well of themselves at puberty.

STRICTURE OF THE URETHRA.

Stricture of the urethra may be congenital or acquired. The former is rare except at the meatus, or within a short distance of it. The latter is due to the deposit of lymph in its walls, so that the diameter is lessened and the elasticity impaired.

The causes are: 1. Gonorrhœa. In slight cases the mucous membrane only is involved. There is hyperæmia, a profuse secretion of mucus, and an excessive production of epithelial cells, which are thrown off, and form a semipurulent discharge. If severe, the inflammation spreads more deeply into the submucous tissue, and even into the corpus spongiosum; a large amount of exudation is poured out round the urethra, the swollen and congested walls of which are thrown into folds, and compressed together. The lymph may be absorbed; but, if not, it becomes organised round the collapsed tube, and leaves a firm, hard ring of variable extent and depth, with, like all other circular bands of lymph, no matter where, an inveterate tendency to contract.

2. Injury. Blows in the perinæum (*e.g.* from falling astride a rail) cause partial or complete rupture of the urethra immediately under the pubic arch; the rent is repaired by the exudation of lymph (which is often so abundant as to form an abscess), with the

same tendency to contract, until a stricture is produced more obstinate and tighter than any other.

3. Ulceration of the mucous membrane. This is most often due to chancre, but it may occur in gonorrhœa, or be the result of injury, as, for example, impacted calculus and violent catheterisation.

4. Masturbation and urethritis from other causes. No history of injury or of gonorrhœa can be obtained in many cases, so that it is possible it may occasionally be due to these. Whenever an organic stricture is present the urethra is irritable, and there is a tendency to congestion of the mucous membrane, and spasmodic contraction of the unstriped muscular fibre in its walls. Indeed, organic stricture rarely causes retention of urine by itself. Some slight irritant, that would not affect the urethra when healthy, excites one or both of these additional obstructions, and complete retention is the result.

Sometimes, when there is no stricture, retention of urine is caused by swelling of the mucous membrane, as in acute gonorrhœa and prostatitis, or by spasmodic contraction, due to reflex irritation from the rectum or other sources, but the pathology and treatment of such cases of obstruction differ totally from those of organic stricture.

Varieties.—There are various terms applied to strictures. When a band of lymph stretches across the urethra, attached only by its ends, it is called a *bridle stricture;* it is *annular* when the constriction is circular, as if a piece of string had been tied round; and *indurated annular* if the base is much infiltrated. Sometimes this is so extensive that it is said to be *cartilaginous.* Some strictures, again, are *irritable*, if chills or rigors often occur; others are called *contractile* or *recurring.*

In the strict sense of the term, not stricture is *impermeable*, except those in which, as a result of injury or of inflammation, a large portion of the wall of the urethra has sloughed away. But in reality, in many old cases, owing to the length and tortuous character of the channel left, it is impossible to pass a bougie, even though urine may continue to trickle away drop by drop.

Locality.—Strictures are met with in different parts of the urethra, with very different degrees of frequency. They are never found in the prostatic portion; this is the widest and most easily dilated part, and no case of stricture affecting it exists in any museum.

In the penile part they are very common, and may exist in any number. As many as six different ones have been found, but the favourite spot by far is just in front of the membranous urethra, in the bulb. Here the wall is soft, and very vascular, and there is abundance of submucous tissue, so that the amount of lymph thrown out, whether the result of gonorrhœa or injury, is great in proportion. Admittedly this part is capable of great dilatation, but it must be remembered that, except while the urine is actually flowing through, the walls, here as elsewhere, are wrinkled up into folds and compressed together.

Otis and Verneuil, as a result of clinical observation, hold that strictures are more common in the anterior part of the urethra, and that deeper ones are really but spasmodic muscular contractions, secondary to them, consequent on the irritation caused by the true stricture in front. These, of course, are not strictures in the correct sense of the term, and cannot be found post-mortem.

Consequences. — The mucous membrane in the neighbourhood of a stricture does not long remain unaffected. The outflow is obstructed, and the uniform elasticity of the canal destroyed, so that undue stress falls on it, and irritates it. Hyperæmia and inflammation result. The *urethra* behind becomes dilated, and its walls thinned; often it presents a reticulated appearance from the dilated orifices of the numerous small ducts that open on its surface. The amount of secretion increases, and this flowing away is the cause of the gleet. Ulceration even may ensue, and then there is extravasation of urine into the corpus spongiosum, or wider still in the tissues round. These changes are not limited to the surface; a large amount of lymph is poured out all round, so that sometimes abscesses form independent altogether of the urethra, and either open into it or burst on the exterior.

The *bladder* suffers even more severely. Owing to the increase in the labour of expelling the urine, the muscular coat becomes uneven and hypertrophied; the walls lose their uniform flexibility, and become irregular, unyielding, and inelastic; the cavity itself diminishes, and when the bladder contracts, the mucous membrane is no longer thrown into regular folds, so that some of the contents remain behind. Chronic inflammation is the consequence. Then the bladder empties itself more and more often; the capacity diminishes steadily; the walls get thicker and more irregular from the increased amount of work, and

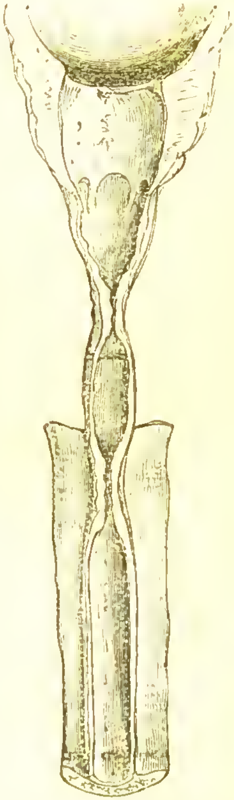

Fig. 52.—Double Stricture of the Urethra, with Dilatation of the Prostatic Urethra. (Middlesex Hosp. Museum.)

the weaker portions yield from the pressure until they project outwards as pouches or sacculi between the hypertrophied bands of muscle. The walls of these dilatations rarely contain any of the muscular coat; they are formed merely of mucous membrane and of peritoneum, so that they are never emptied.

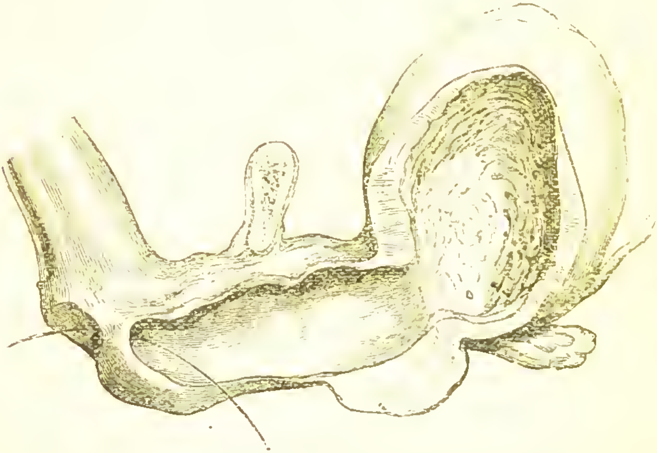

Fig. 53.—Dilatation of the Urethra and great Hypertrophy of the Bladder behind a Stricture. The Stricture is shown by a bristle. (Middlesex Hosp. Museum.)

Then, if it has not already taken place, the urine decomposes, and matters become tenfold worse. The inflammation becomes more intense, and either the sacculi themselves become abscess cavities, or deposits of pus form in the walls and burst into them.

Sometimes, on the other hand, when the obstruction is sudden, and the obstacle too much for the bladder to overcome, the bladder becomes distended so as to reach the umbilicus, and its over-strained walls lose altogether their power of contraction (atony), or it gives way (though this more commonly happens to the urethra behind the strictured part), and the urine is extravasated into the cellular tissue of the perinæum and scrotum.

These alterations are not confined to the bladder. The *ureters*, the pelvis of the *kidneys*, and the renal secreting structure itself all share the same fate. The continual pressure gradually but surely causes absorption, and chronic inflammation and suppuration follow in its wake, due partly to the tension, partly to the gradual upward extension of the inflammation. Suppurative pyelitis or nephritis is present in at least one half of the fatal cases of stricture.

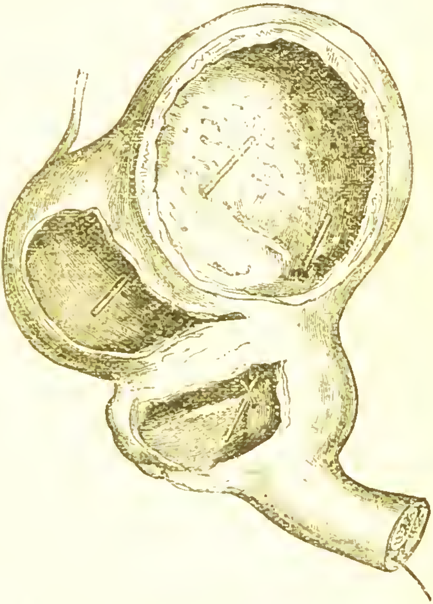

Fig. 54.—Abscesses resulting from Stricture. One abscess is in the prostate, the other behind the bladder. Both abscesses communicate with the bladder cavity. A bristle marks the urethra. (Middlesex Hosp. Museum.)

Symptoms.—The symptoms depend on the length of time the stricture has lasted, and on the degree of contraction it presents; but in all cases of this kind there is a very large personal element to be taken into consideration. It is not merely that some people pay attention to, and are much more anxious about, small symptoms than are others, but that the urethra in some is more sensitive, much more likely to be affected by spasm and congestion, In some cases irritating conditions of the urine, such as an excess of uric acid, alcoholic or other indulgences, exposure to cold or wet, constipation, and many other slight causes, bring on such a degree of spasm and congestion that complete retention of urine results, when the real stricture present would of itself admit a No. 6 catheter.

The most constant symptoms are: 1. A chronic urethral discharge or gleet, especially in the morning and after exercise. The first few drops of urine at each act of micturition wash out from the urethra shreds and filaments of mucus from the inflamed part; the rest follows quite clear.

2. Pain, felt at the seat of stricture during micturition, owing to the state of tension set up in the inflamed and congested part. Sometimes a thickening of the tissues, especially in old cases, may be felt in the same place.

3. Alteration in the stream of the urine. It may be forked, or twisted, or flattened; often it is diminished in size, so that when the stricture is old the urine only comes in drops. Frequently, even in slight cases, there is some trouble at the end, the last few drops flowing away of themselves.

4. Retention. This may be the first and only symptom. As already mentioned, it may come on suddenly, even when the diameter is, comparatively speaking, of good size. The urethra, when inflamed, is more sensitive even than in the normal state, and a very slight cause will set up sufficient spasm to close the already narrowed canal.

5. Later, many other symptoms follow, due to the implication of other organs. The character of the urine is changed; its reaction becomes alkaline, and it is loaded with mucus and phosphates. The bladder is irritated, and empties itself more and more frequently, so that often it is impossible to secure a

night's rest. Pain is felt over the pubes, in the perinæum, and across the loins. The constant straining affects the rectum, so that hæmorrhoids or prolapse occur, and the patient is unable to pass water without emptying the bowel at the same time. The kidneys suffer next in order; the condition of the blood is seriously changed. Digestion is impaired, nutrition fails; the patient becomes weak and anæmic, prone to rigors, and if some accidental source of inflammation does not prove too much for his powers of resistance, he sinks gradually from weakness and exhaustion, or succumbs to partial or complete suppression of urine.

Diagnosis.—Stricture must be diagnosed from (1) subacute inflammation of the prostate, and (2) urethral irritability, set up either directly by disordered conditions of the urine, or reflexly through some of the neighbouring organs, such as the rectum.

In the former the symptoms are dependent on the inflammation of the mucous membrane of the urethra, just as they are in stricture, so that without further exploration it is impossible to be certain. The presence of induration, felt outside along the course of the urethra, or of retention, would point to stricture, and rectal tenderness to inflammation of the prostate, but neither of these would exclude the possibility of the other.

So also with urethral irritability: stricture itself is one of the many causes of this complaint, so that from the symptoms alone, without further exploration, it is not possible to form a certain diagnosis.

The instruments made use of for exploring the urethra are catheters, bougies, and sometimes sounds. If the presence of a stricture is suspected, and it is considered advisable at once to explore the urethra, an instrument must be selected of such size that while it will pass without much discomfort through a normal urethra, it will not catch in any of the irregularities (as a small sharply pointed one does), but will open out all the folds as it passes along; and of such material that the slightest roughness of the surface will at once transmit an impression to the hand of the operator. These conditions are best fulfilled by a metal instrument of eight or nine English gauge, rather smaller in the shaft than at the end; this will pass through any normal urethra, will not raise up folds of mucous membrane in front of it, and transmits sensations much better than a gum elastic or black one.

The passing of catheters.—The patient should lie down, with his shoulders slightly raised, the hips a little flexed, the thighs abducted, and the umbilicus exposed. The operator stands on the patient's left, and having well warmed and oiled (or better, covered with vaseline) the instrument, he holds the penis with his left hand, and quietly draws it over the end. The catheter is to be kept exactly in the middle line; there is no advantage to the patient in deviating either to the right or left. The penis should be well stretched forwards and upwards, so as to obliterate as far as may be any folds of mucous membrane in the interior, and the point of the catheter should be kept at first towards the floor to avoid its catching in the lacuna magna.

The force required for the introduction of a catheter is so slight in a healthy urethra that its own weight is almost enough. Sometimes, when the mucous membrane is very sensitive, as it often is in gouty people, the unstriped muscular fibre grasps the instrument firmly, so that it does not move easily in either direction. It is best under these circumstances to wait a minute or two. The spasmodic contraction of unstriped muscle comes on slowly, lasts some little time, and then inevitably tires itself out. When the first catheter is held in this fashion, it often happens that one or two or three sizes larger may be passed quite easily immediately after.

Gradually, as the catheter enters, the handle rises up until the position is almost vertical. The point has now reached the bulbous portion of the urethra. Here there is a considerable dilatation on the floor, and the mucous membrane is very loose and readily thrown into folds. The orifice of the membranous part is much smaller, quite rigid, being situated in the triangular ligament, and well above the middle line. Unless, therefore, the handle of the catheter is depressed between the patient's legs (and sometimes, in the case of an enlarged prostate, it has to be depressed so far that it becomes horizontal), and unless the point is kept pressed against the roof, it cannot hit off the opening. False passages nearly always start from here, and run upwards and backwards between the rectum and the prostate, entirely because this caution is not observed. If the finger at this stage is introduced in the rectum, the point of the catheter can be felt just at the apex of the prostate gland.

If the catheter is not held firmly, it often slips into the membranous part with a smart jerk, and gives the patient a good deal of pain. This is normally the most sensitive part of the urethra, and the most likely, when injured, to cause reflex trouble.

It sometimes happens that a catheter must be passed at once for the relief of urgent symptoms, but it must never be forgotten when it is being done merely for the purpose of exploring the urethra, that it is always a serious matter for the patient, especially if it is the first time; and that though men whose kidneys are diseased, and who are suffering from long-standing stricture and bladder trouble, are infinitely more liable to serious after-consequences than others, yet that these have happened, and have proved fatal, even when no predisposing causes of this nature were present.

Hæmorrhage, false passages, urethritis, perineal abscess, prostatitis, cystitis, and epididymitis (none of which are uncommon), may be reasonably assigned in the majority of cases to causes apparent on the surface, and the same may possibly be said of urethral rheumatism and pyæmia; but shock, rigors, urethral fever, and especially suppression of urine, may occur without the least violence having been used or the slightest lesion being found. It is probable that nearly all operations, no matter how slight, about the deeper portion of the urethra and the bladder (the penile part seems exempt), cause, by some obscure reflex action, congestion and hyperæmia of the kidney. If this is slight and the kidney sound, the only result is a certain amount of blood in the urine for some short time; if it is continual, probably interstitial nephritis results; but if the kidney is already diseased the congestion may be so intense as to cause suppression.

The patient should, if possible, always be prepared beforehand; the bowels should have been well opened, he should be kept warm, made to lie down afterwards, and should be directed not to pass his urine for some considerable time, and to remain quiet after he has done so. If symptoms of a rigor come on, a large dose of quinine or a breakfast cup full of hot tea sometimes cuts it short.

Hydrochlorate of cocaine may be made use of in these cases with great advantage. Five minims of a 4 per cent. solution injected into the meatus, followed, in three or four minutes, by a somewhat larger amount, injected, by means of an elastic catheter or a syringe, into the bulbous part or on to the face of a stricture, entirely gets rid of the pain without quite destroying sensation, and thus depriving the operator of the advantage he may derive from the patient's guidance.

If in a case of supposed stricture a No. 9 English passes easily, without being held at any one spot (though it may at first be somewhat tightly grasped along its whole length), and particularly if it slides out smoothly and evenly, a larger one (No. 11, or even 12, if the meatus permits) may be introduced. If this passes and is withdrawn equally easily, without coming across any roughness or obstruction, and particularly if there is no acute pain except when the point of the instrument is at the membranous part, it may be taken for granted that there is no stricture present.

It is true that Otis in particular has described what are called strictures of large calibre as existing in the anterior part of the urethra, and causing the symptoms of organic stricture deeper down by the reflex spasm they excite; and it is not denied that sometimes infiltration in the mucous or submucous tissue may cause a certain amount of hardness and of reflex irritation of the unstriped muscle of the urethra (just as sometimes obstruction to the passage of urine is caused by reflex irritation from the rectum), but it is impossible to class such cases of obstruction with those in which this symptom is due to a firm band of lymph round the urethra, so tight that it will scarcely allow the passage of a drop of fluid. In the one there is a permanent cicatricial contraction, the result of inflammation; in the other there is obstruction, due to muscular spasm, which may be caused (in this particular case) by the presence of an irregular or tender spot in the anterior part of the urethra, just as it may be by fissure of the rectum.

If a moderate-sized catheter does not pass, smaller and smaller sizes must be tried. In this way the distance of the stricture from the orifice, and the diameter of the smallest part, may be ascertained, but not the length or the possible presence of deeper ones. The latter point, if the deep stricture is larger in diameter than the nearer, can, of course, only be cleared up by the dilatation of the latter. The former can be ascertained fairly well, either from the exterior, or by passing bulbous bougies on a metal stem. If one of these is passed through the stricture, on drawing it back the spot at which it meets it can be accurately noted, and marked on the stem; but it must not be forgotten that the submucous tissue of the urethra is lax and loose, and that it is easy, by a little gentle pressure or traction, to displace a stricture a considerable distance. Flexible bougies with bulbous ends manufacture strictures for themselves, unless they are kept exactly in the axis of the canal, by doubling up folds of mucous membrane, and slipping over them.

Treatment.—Strictures may be divided into two classes: A. Those through which a catheter can be passed. B. Those which are practically impermeable.

The former may be treated by (1) Dilatation: (*a*) continuous; (*b*) intermittent. (2) Rupture or splitting. (3) Cutting or urethrotomy: (*a*) internal; (*b*) external. (4) Excision.

It must not be imagined that because a catheter cannot be introduced on the first occasion into a stricture that it is, therefore, impermeable. If the urethra has sloughed, or if it is a long cartilaginous stricture of many years' standing, with a very small tortuous passage, this may be the case; but in the vast majority of instances, as already mentioned, the immediate cause of the closure is the congestion of the mucous membrane and spasmodic muscular contraction. This may easily be relieved; and it will often be found that an apparently impermeable stricture in a few days admits a No. 3, or even No. 4, catheter if the patient is kept quiet in bed, on low diet, without stimulants, and given a hot bath night and morning. Opium, too, is of great service; but the bowels must be kept open at all costs. Not until this has been thoroughly tried, and every form of catheter used, should a stricture be condemned. In this respect the treatment of stricture must be carefully distinguished from that of retention. The former may wait a short time; the latter is immediate in its urgency.

1. *Dilatation* is the easiest and the safest method. It succeeds best with strictures of recent formation in young subjects, whose kidneys are still fairly sound, who are not prone to rigors, and whose strictures have not yet assumed the dense cartilaginous resistance common later on. It may be intermittent or continuous. In *intermittent dilatation* catheters are passed every two or three days, but are not left in; they are simply introduced and withdrawn. Three or four sizes may be passed at each sitting, but it is always as well not to commence with the largest used on the previous occasion; one a size smaller is much less apt to cause irritation.

In *continuous dilatation* a small catheter is introduced through the stricture, and tied in so that the end only lies just within the bladder. For this the patient must be confined to bed, or, at the very most, allowed to sit up; certainly not to move about. The catheter may be left in three or four days, but it is better to change it at least every second one, for fear of its setting up cystitis and becoming encrusted with phosphates. It need not be a large one, or, indeed, fill the stricture. It is a singular fact, and one for which there is no satisfactory explanation, that a stricture dilates equally well with a small as with a large one. Indeed, a catheter that just fits should not be tied in, as it is not unlikely to cause irritation.

The former of these methods depends entirely on mechanical dilatation. A catheter passed every third day can have no other effect. In the latter there must be some other influence, for it is often found when the instrument has been left in some days that it lies quite loose in the stricture; the process is not merely a mechanical one, whether it is or is not true that the effusion in the submucous tissue is absorbed by the pressure.

Neither of these methods can be said to cure stricture. After dilatation a catheter must always be passed at first every third day, then every week, and after some considerable time every month: otherwise the contraction will recur. Each method is liable to all the accidents of catheterism; the continuous more especially to the inflammatory ones, such as urethritis and cystitis.

Metal instruments are for this purpose not nearly so useful as flexible ones. The object here is not diagnosis, but to insinuate down a tender and contracted passage some instrument that will inconvenience it least. The more flexible it is, the more easily it finds its way and accommodates itself to the turns and twists of the urethra, and the less damage it inflicts. The stem must have sufficient rigidity to bear the onward pressure; the point must be rounded and slightly enlarged, so that it may not catch in obstructions; and the neck as flexible as is consistent with strength, so that the point may bend in all directions with the least touch.

If these fail, even after the patient has been kept perfectly quiet, recourse must be had to catgut and other bougies. The former are particularly useful, as the point may be slightly bent on itself, so that when the bougie is twisted round in the urethra (care being taken that the direction corresponds with the make of the gut), it will explore a circle on the face of the stricture, and not a single central point, as it does when it is straight. In this way an orifice lying a little to one side of the centre may often be hit off.

The search, however, must be carried on in a regular manner and with a definite object in view, not blindly here and there.

Whalebone bougies are not so much to be recommended; they are much stiffer, and it is exceedingly easy to make a false passage with them. The same holds good of a silver instrument of small size; unless this is held with the lightest possible touch, its point inevitably perforates the mucous membrane, and makes a false passage.

Sometimes it is advisable to use long, flexible, whip-like bougies, attached to the end of a stiff one of larger size, so that the whole length is at least double that of an ordinary catheter. If the flexible part can find its way, the stiffer portion will follow, and the former coils itself up in the bladder out of harm's way. Or the same result may be obtained by railroad catheters, *i.e.* catheters with an eye at each end, so that they can slide along the catgut into the bladder, and remain there after the guide has been withdrawn.

The simplest fashion of securing a catheter in the bladder is to attach two threads to its eyes, one on either side, and fix them to the skin of the penis by a piece of strapping wound round it near its root. Or, as this plan has certain obvious objections, and is not too secure, to knot the threads (which must be double) on either side about an inch and a half from the catheter; then, taking the two threads of one side, carry the one over, the other under the penis, so as to enclose it in a loop; knot them together on the opposite side, and tie them to the pubic hair. The other pair is then to be treated in the same way.

Or a tape is fastened round the abdomen, and starting from this on either side, a loop is carried over the outer side of the opposite thigh, then under it, so as to come up in the groin by the side of the scrotum, and be fastened again to the waist belt. The tapes from the catheter are tied, one on each side, to the band in the groin, just opposite the root of the penis, so that it can assume any position that is convenient without allowing the unstriped muscular fibre of the urethra to push the catheter out.

2. *Rupture or splitting.*—The dilatation of a stricture may be accomplished at one sitting by the rupture or the splitting of its fibres. The instrument commonly used for this purpose is that known as Holt's, or some modification of it. The principle consists in passing down through the stricture an instrument shaped like a catheter, but composed of two parallel halves, which are suddenly separated from each other by forcibly driving down between them a large metal rod, made for the purpose, in different sizes. It is claimed for this that it dilates the tissue of which the stricture is formed without lacerating the mucous membrane, and certainly the process is simple enough; but there is no guarantee that the force is applied to the right place, and it is certain that relapses after this method of treatment occur very early. In the case of a stricture in the bulbous portion it can scarcely succeed; the diameter here is so much wider than that at the meatus or in the membranous part that dilatation sufficiently extensive to cause complete rupture is impossible.

3. *Urethrotomy.*—Urethrotomy is either external or internal, that is to say, with or without an incision in the perinæum.

In the latter, the stricture may be divided from before backwards in exceptional instances, but nearly always the instrument is passed through it first and then withdrawn with the blade exposed, so as to incise the constriction freely from behind forwards. Consequently, it is essential that the stricture should be dilated first to the size of a No. 5 catheter.

Certain kinds of stricture are especially suitable for *internal urethrotomy.*

1. Strictures near the meatus, and, to a less degree, those deeper in the penile part.

2. Strictures which re-contract rapidly after dilatation.

3. Strictures in patients who suffer severely from rigors or other troubles whenever a catheter is passed. In cases such as these it is best to finish the operation at a single sitting, so that if rigors follow, there is but one. It is often found, when a stricture is thoroughly divided, that the urethra completely loses its irritability.

4. Dense cartilaginous strictures that refuse to dilate. Though, so far as these are concerned, it is doubtful if external urethrotomy does not answer better.

It is usual to make the incision on the floor, but this is not essential. There are, it is true, a few large veins on the roof in the angle between the corpora cavernosa and spongiosum, but even if these were incised the hæmorrhage would not be serious.

It is more important to divide the stricture completely through its whole depth. Anything short of this is followed by failure. It may be performed in two ways, either with a urethrotome, such as Thompson's, consisting merely of a bulb on a stem concealing a blade which, by means of a screw, may be protruded any depth that seems to be required; or with Otis's, in which the urethra is first of all put on the stretch in the strictured part, and then incised a certain fixed depth by drawing a blade back along a grooved guide. If the stricture is not thoroughly cut through, the side rods of the instrument may be screwed apart again, and a fresh incision made. Urethrotomy has been compared with tenotomy, and no one would willingly divide a tendon when it was relaxed.

Both of these plans succeed admirably in the anterior part of the urethra: the one because the strictured part can be held with the fingers through the skin, fixed, and every fibre felt as it is divided; the other because the touch of the instrument is so exceedingly light when it is but a short way down the mucous canal. It is much more difficult when the bulbous portion of the urethra is involved. Probably here Thompson's urethrotome is the handiest, as the instrument can be held lightly, and the division of the tissues can be felt. Owing to the divergence of the corpora cavernosa and the gradual separation of the veins from the corpus spongiosum, the incision, if on the roof, may be carried to a very considerable depth without wounding any important structure.

Whatever instrument is employed, a large bulbous sound (No. 14 English) should be passed immediately after. If this enters easily, particularly if it can be withdrawn without meeting with any obstruction, it is taken for granted that the stricture is thoroughly divided. There is no need to tie a catheter in unless hæmorrhage is feared. The edges of the incision, if the division is thorough, retract so that immediate union cannot take place, and the presence of a catheter does not prevent urine finding its way into the cut, for when a catheter is tied in the bladder, some always makes its way out round it. The bladder should be emptied at the time of the operation, and a morphia suppository introduced into the rectum; if the patient is left quiet in bed, without too much to drink, there is no urgent call for him to pass water for at least six, and, perhaps, twelve, hours.

By that time the surface of the wound is glazed over, and this affords the best protection both from the entrance of urine into the cut and the rigors that sometimes follow the first act of micturition after an operation.

Internal urethrotomy is liable to be followed by the same complications as simple catheterism, but some are more common and more serious than others. Hæmorrhage (not so much at the time, but some hours later, in the course of the night, especially if there is an erection) is not rare, though it is seldom grave. Supporting the penis and perinæum on a well-padded, but firm, crutch, and laying an ice bag over it, generally controls it; or if in the penile part, a catheter may be passed, and a bandage placed firmly round. Extravasation of urine, leading to perineal abscess, also occurs; but though this is painful, and delays convalescence, it rarely leads to any permanent trouble if the stricture has been divided completely.

Urethritis, or cystitis, if existing before the operation, is generally made worse for a time; but unless a catheter is tied in, they rarely originate from it. Rigors may occur either immediately or when urine is first passed, but, as a rule, they are not followed by anything further. When they come on at other periods they are more serious, as they may be the first indication of urethral fever, suppuration, nephritis, or even pyæmia. The prognosis, so far as life and health are concerned, depends on the state of the kidneys more than anything else, as it does in all operations on the urinary organs. If they are diseased, suppression of urine, or some other trouble, is very likely to happen; if healthy, it would be quite exceptional, though not altogether unknown.

Three or four days after the operation the patient may be given a hot bath, and a soft flexible catheter (No. 12) passed; if it enters easily, it may be repeated in two or three days' time, and after that at regular intervals. This should not be omitted any more after internal urethrotomy than after dilatation. In each it is essential to continue the passage of a catheter, with intervals gradually getting longer and longer, for years. A patient who has once had a well-defined stricture is never free from the fear of relapse.

External urethrotomy.—Two conditions chiefly render an incision in the perinæum advisable. The first is the presence of a stricture so dense and unyielding, or so complicated with fistulæ, that internal urethrotomy cannot succeed; the second where it is not possible to get a catheter into the bladder at all, whether this is due to obliteration of the urethra or to the length and tortuous character of the stricture. In the first case an instrument is passed, and the stricture divided upon it. This is external urethrotomy in the strict sense of the term. Syme's staff is the one generally used. It is grooved on the convexity, and consists of two parts of different diameters, which meet with an abrupt shoulder at the junction of the straight portion with the curve. The latter is the smaller of the two, so that it can pass through the contracted part of the urethra until it is brought to a standstill by the shoulder coming in contact with the face of the stricture. The patient is placed in the lithotomy position, and a median incision made into the groove, taking care to divide thoroughly the whole length of the stricture. A probe is then introduced into the bladder to act as a guide, the staff withdrawn, and a catheter passed to make sure there is no further obstruction. It should not be tied in, but passed again on the third or fourth day, and then at intervals afterwards.

This method of operating is exceedingly valuable in cases that are not so far advanced as those mentioned above. Under the free suppuration that follows, a great deal of the old inflammatory deposit melts away, and if, when the wound is healing, catheters are passed regularly, the new tissue that forms does not acquire the density of the old. It is a more severe operation than internal urethrotomy, but it is free from the objection sometimes urged against this, *i.e.* that urine may collect in the wound, set up a large amount of suppuration which has not free escape, and leave behind a tougher and firmer stricture than the one divided.

If a catheter cannot be passed through the stricture, the urethra must either be opened in front of the stricture, after Wheelhouse's method, or perineal section must be performed.

In the former, the patient is tied up in the lithotomy position under an anæsthetic, and a grooved staff, with a button on its end, carried down to the face of the stricture. An incision is made in the middle line down to the groove, so as to open the urethra freely, and the sides of the incision held apart by means of two sutures passed through the mucous membrane and given to one of the assistants. If the upper angle of the incision is then hooked up by means of the button on the end of the staff, the hæmorrhage which sometimes obscures the view is checked by the tension, and the whole interior of the urethra in front of the stricture thoroughly exposed, with the light falling on its inferior angle. Under these circumstances the orifice can generally be seen, and a probe insinuated down it. As soon as this is done, the stricture is divided freely, and a catheter passed along it into the bladder.

Perineal section.—In this the urethra is laid open behind the stricture. The patient is placed in the lithotomy position, care being taken that he is perfectly straight, and that the perinæum is perpendicular. The operator sits in front, and with his left fore-finger feels for the apex of the prostate. He then takes a long straight knife, and, with its back towards the rectum, plunges it steadily in the middle line underneath the bulb, so as to hit off the membranous part or the apex of the prostate. A director is then passed into the bladder, and a soft catheter introduced, and, if necessary (as these wounds close very rapidly), tied in. Later, when the fistula is well established, it is found not unfrequently that the stricture, which obstinately resisted all attempts before the operation, can be passed easily and divided.

4. *Excision.*—Attempts have been made to excise portions of the urethra, the seat of stricture, but the procedures have not met with any degree of success. For excision the stricture should be of limited extent and in the penile urethra, and stenoses so placed are amenable to simpler treatment. At present the operation cannot be advised.

EXTRAVASATION OF URINE.

Urine may be extravasated from the ureter and pelvis of the kidney, from the bladder (escaping either into the cellular tissue or into the peritoneal cavity), and from the urethra. The last mentioned is infinitely the most common, and is generally understood when extravasation of urine is mentioned.

Causes.—It may be due to injury, or to ulceration behind a stricture, and take place either above the triangular ligament of the urethra, between its layers, or below it, on the superficial surface. In the first case the symptoms and treatment are those of ruptured bladder; in the second a dense hard lump forms deep in the middle line of the perinæum, until one of the layers (generally the superficial) gives way; in the third, owing to the attachment of the deep layer of the superficial fascia, the urine spreads forwards and upwards into the scrotum, and on to the anterior wall of the abdomen, perhaps as high as the ensiform cartilage.

Consequences.—Wherever urine spreads in the cellular tissue it causes inflammation and sloughing. The penis, scrotum, and the anterior portion of the perinæum, swell up, become red and œdematous, and in a very short time the cellular tissue and skin slough and decompose.

Symptoms.—The patient, if he has been suffering from retention, usually states that during some effort he suddenly felt a sensation of great relief, but without any urine coming, and that a short time after he was seized with an intense burning pain in the perinæum, which almost at once commenced to swell. At the first there is always high fever, corresponding to the severity and extent of the inflammation; but, especially if the kidneys are diseased, it rapidly assumes a typhoid character, the tongue becomes dry and brown, the eyes sunken, sordes accumulate round the lips and teeth, the pulse is small and very frequent, the skin dry, and often icteric, diarrhœa sets in, and there is great depression of the nervous system during the day, and wandering delirium at night.

Treatment.—The patient must be placed at once in the lithotomy position under an anæsthetic. A finger should be introduced into the rectum to see that it is clear and not much distended forwards, and an incision should be made into the middle line of the perinæum until the source of the extravasation is tapped. Then wherever the urine has spread incisions must be made through the skin into the sodden and œdematous cellular tissue in suitable directions. Each should be about three inches long, and should penetrate well into the sodden mass; when the urinous fluid and serum have poured out, they shrink in a most surprising manner. Hæmorrhage is rarely severe. A small artery would be tied or twisted; if the oozing continues it may be checked by the pressure of dry strips of lint.

There is no need to deal with the stricture at the time. If the perineal incision is rightly planned, all the urine drains from the bladder as from a fistula, so that there is no fear of further extravasation.

Afterwards, when the patient has recovered from the sloughing and inflammation, and the strictured part has been left completely at rest, it may be dealt with on its own merits. It is as well to do as little as possible until the patient's strength has recovered, for these cases are singularly apt to be followed by a form of pyæmia.

The prognosis is always grave, especially when it is the result of stricture, for the kidneys then are almost certainly diseased. Sloughing and gangrene are often very extensive; the fever nearly always assumes a typhoid character, with symptoms of septic intoxication, and if the patient recover from this there is still the danger of exhaustion from prolonged suppuration, and the necessity of further measures to relieve an inveterate form of stricture in a patient already worn out by protracted illness.

URINARY ABSCESS.

Urinary abscess nearly always occurs in connection with stricture. It may be due to ulceration of the mucous membrane and extravasation of a minute quantity of urine, or it may originate independently of this, as a peri-urethral abscess, due to the breaking down of the lymph thrown out by the tissues round a stricture, and bursting either into the urethra, or externally, or in both directions.

Symptoms.—There is a sudden rigor, and an intense throbbing pain in the perinæum. The pulse is rapid, the skin hot and dry, the face flushed, and the tongue parched. The bowels are constipated, and perhaps there is complete retention of urine. On examination a tense, hard, and painful swelling can be felt in the region of the bulb, generally speaking, or in the penis, or often extending down the median raphe of the scrotum. And nearly always there is a history of stricture (for abscess rarely forms until the contraction is advanced) or of some injury to the perinæum.

Treatment.—The abscess must be opened at once, and if there is a stricture through which a catheter can pass anywhere near the base of the abscess, it should be divided freely from the perinæum, so that, as in the operation of external urethrotomy, the wound may granulate up from the bottom, an instrument being passed every two or three days to maintain the patency of the urethra.

If the catheter does not pass easily, or if the connection between the stricture and the abscess is not clear, it is as well to wait, and be content with opening the latter. Very often the stricture, being left to itself, no longer irritated by the impact of the urine, and after the congestion has been relieved by the local bleeding, admits an instrument readily in the course of a few days.

Urinary fistula is the result of abscess in connection with the urethra, and accordingly is most often due to stricture. There may be a single opening in the perinæum, communicating directly with the urethra, or there may be any number situated over the pubes, in the groin, or even in the rectum. It may be recent, with the natural soft and elastic tissues round, or it may be old, dense, and cartilaginous; there may be only a pin-hole opening in the mucous membrane, or a large portion of the wall of the urethra may have sloughed.

Treatment.—As a rule, when the cause is a temporary one (such as impacted calculus), healing is rapid and spontaneous, unless the urethra is extensively injured. When the fistula persists, it is nearly always due to stricture, and until this has been thoroughly remedied, it cannot heal. Sometimes, even after this has been done, the urine continues to drain through the artificial opening, and prevents its closing. If it is of recent formation, success may sometimes be obtained by carefully drawing the urine off from the bladder with a soft catheter. The patient must do this himself, and must never allow a single drop of urine to pass along the urethra until the wound is sound. It is no use tying a catheter in the bladder with this object, as, in spite of all precautions, a certain amount, quite enough to frustrate the purpose, always comes by the side of the instrument.

In old fistulæ particularly, where the sinus is long and tortuous, with dense unyielding walls and more than one external orifice, measures so simple as this rarely succeed. The canal may contract so that very little can come through, but it does not close completely. Injections of tincture of iodine or of nitrate of silver, stimulating the walls by caustic on a silver probe, or by the actual cautery, are of service sometimes, but where there is a stricture, and where the orifices of the sinuses are so situated as to admit of it, the best plan is to perform external urethrotomy and lay the whole of it open. The stricture is thoroughly divided by this; the urine gains a free and straight exit, so that the products of its decomposition no longer adhere to the walls and irregularities of the fistulæ, and the cartilaginous infiltration of the tissues suppurates away. Such an operation, however, is always a serious undertaking.

It sometimes happens, especially in the penile portion of the urethra, that considerable portions of the wall are destroyed by sloughing. When this has happened, plastic operations afford the only means of closing the opening.

(*See* also Recto-vesical and Vesico-vaginal fistulæ.)

RUPTURE OF THE URETHRA.

Causes.—This occurs either on the deep or the superficial surface of the triangular ligament. The former is generally associated with severe injuries to the pelvis, such as separation of the symphysis; the latter, with violent blows in the perinæum compressing the membranous part of the urethra under the subpubic arch, and causing it to give way either partially or completely.

Symptoms.—When the rupture is on the deep surface the symptoms are the same as those of extra-peritoneal rent of the bladder. The patient is unable to pass urine of himself, though a catheter can be introduced without much difficulty. The blood, being unable to escape by the urethra, regurgitates into the bladder, so that it is intimately mixed with the urine, and infiltrates the cellular tissue behind the symphysis, no ecchymosis becoming visible for some time. If free exit is not given to the urine, it gradually makes its way in the same direction, causing symptoms of septic intoxication, from which the patient succumbs.

When the rupture is superficial there is tenderness and ecchymosis in the perinæum, extending forwards into the scrotum; a drop or two of blood escaping from the meatus shortly after the accident; and either a scalding pain on micturition from the urine passing over the raw surface, or complete retention, according to the degree of injury sustained. Extravasation of urine is inevitable in all cases in which the rent is more than a superficial laceration of the mucous membrane, unless steps are taken to prevent it.

Treatment.—A catheter should be passed at once, selecting for choice a metal instrument with rather a short curve. If this fail, a soft elastic or a black one may succeed. The urine should then be drawn off, and if there has been the least difficulty in the introduction of the catheter, or any amount of hæmorrhage from the urethra, an incision should be made in the middle line of the perinæum and the instrument withdrawn.

Under these conditions a certain amount of extravasation will inevitably follow; in all probability, if the rent is so extensive as to cause the loss of more than a few drops of blood, it has taken place already, and an incision is the best way to meet it. It cannot be prevented by tying in a catheter. There is this further advantage in making an early perineal incision, that there is no suppuration due to the retention in the tissues of decomposing extravasated urine; consequently the amount of cicatricial tissue when the wound heals is much less, and the danger of traumatic stricture is reduced to a minimum. Three or four days after a soft catheter may be passed, and then others at intervals until the wound is sound. If it heals without any evidence of constriction of the urethra, the patient may escape; but he should always be warned of the possibility of its setting in some time afterwards, and advised to pass a catheter for himself occasionally. When the urethra is completely torn across, it is sometimes possible to find the two ends in the perineal wound, and unite them together by means of a deep catgut suture.

DISEASES OF THE PROSTATE.

The prostate is liable to **inflammation**, which may be acute or chronic, and may end in resolution or suppuration; and also to a form of enlargement, which is important not so much for itself as for the changes it induces in the bladder. Much more rarely it becomes the seat of cancerous or tubercular deposit, and sometimes calculi are found embedded in its substance, either formed there on a nucleus of organic matter or impacted in it from the bladder.

Acute prostatitis.—This may be due to gonorrhœa, especially in the later stages, when the deeper part of the urethra is involved; to impacted calculus; the passage of sounds or catheters; lithotrity, or other operations about the urinary tract; stricture; the use of caustics; and even, it is said, in gouty subjects, to sexual excesses and masturbation.

The symptoms depend on the severity. It may come on gradually, the patient feeling feverish and restless, with severe pain in the lower part of the abdomen; or there may be a rigor, with throbbing and great tension in the perinæum. Owing to the inflammation at the neck of the bladder there is a constant desire to pass water with a sensation of scalding heat. The stream is small and ejected without force; as the swelling and congestion become worse it stops altogether. The anxiety, distress, and fever rapidly increase; there is tenesmus, and a constant sense of fulness in the rectum, with severe pain at each effort.

On examination, the perinæum is hard, tense, and tender; the temperature of the rectum is raised; the prostate can be felt projecting into it, exquisitely tender, hard, and firm in the early stages, soft and fluctuating if an abscess has formed round.

Prognosis.—The symptoms may subside gradually, the hardness and tenderness slowly disappearing; or the inflammation may become chronic; or suppuration may set in, sometimes in the gland itself from extension of the inflammation down the follicles, sometimes round it, beneath the reflexion of the recto-vesical fascia. In the first case the abscess works its way towards the urethra, and either bursts into it or is ruptured by a catheter; in the other it points in the perinæum or rectum. If the fever continues high, particularly if chills occur, this may be expected; but exceptionally, after operations, large chronic abscesses form in the region of the prostate without any definite local symptoms, and point in the ischio-rectal fossa or even farther off.

Treatment.—The first thing is to relieve the distension of the bladder. The patient must be placed in a hot bath until he begins to feel faint; half a drachm to forty minims of laudanum or some equivalent preparation must be given him, and with it something that will cause a speedy action of the bowels. If relief is not attained in this way, or if, as very often happens, the symptoms are so urgent that the patient cannot wait, the urine must be drawn off by catheter, and in all probability this will have to be done for several days. The best instrument is a black one with the end bent up (coudée) so that it may ride over the obstruction, or a gum elastic with the stilet in, as this may be manipulated over it in the same way. It should be of medium size, not too large, owing to the diminished calibre of the urethra, and not so small as to catch in the folds of mucous membrane.

The alkaline carbonates may be given freely, well diluted, to render the urine as unirritating as possible. Leeches should be applied to the perinæum, and the bleeding encouraged by hot sponging and fomentations. The bowels should be kept well open, both to prevent congestion of the liver and to keep hard masses of fæces from pressing on the tender prostate; and enemata of water, as hot as can be borne, may be given to relieve the throbbing. The pain and straining are best held in check by morphia and belladonna suppositories.

Sometimes suppuration cannot be prevented. If it is suspected it is best not to wait; a single median incision in the perinæum does no harm, while the free hæmorrhage often relieves the tension and alleviates the pain. If pus is already present, the abscess must be opened wherever it points, in the rectum, perinæum, or urethra. Owing to the tissues round the abscess being so tense the cavity contracts at once, and fistula or extravasation of urine rarely occurs, at any rate in acute cases.

Chronic inflammation of the mucous membrane, involving the gland itself to a certain extent, is much more common, and is often mistaken for calculus. It may be the relic of an acute attack, or result directly from gonorrhœa, stricture, masturbation, or gout.

Prostatitis.—*Symptoms.* There is increased frequency of micturition; the stream flows away, especially the last few drops, without any force; almost always there is pain and scalding towards the end of micturition, and sometimes a few drops of blood escape at the same time. Shreds of mucus and casts of the prostatic follicles accumulate in the urethra, and are either washed down with the first few drops or exude from the meatus during defæcation. In the latter case they are often mistaken for the secretion of the testes, and patients become convinced that they are suffering from spermatorrhœa. Gleet is not present unless the urethra in front of the compressor urethræ muscle is involved as well.

A constant aching pain is felt in the perinæum, down the thighs and across the loins, much more severe during defæcation and micturition, because then the prostate is compressed. Then dyspepsia follows, or hæmorrhage from the venous engorgement and constant straining. The irritation spreads to the neck of the bladder, and cystitis, slight at first, but very persistent, is added to the rest, and brings with it hypertrophy and loss of elasticity of the walls. At last the health breaks down completely, and mental as well as bodily vigour is seriously impaired.

Treatment.—Much may be done in cases such as this by attention to general principles; by avoiding stimulants, sexual indulgence, excessive exercise, especially on horseback; by the use of tonics, iron, nux vomica, and phosphoric acid; by laxatives to regulate the bowels, and by fresh air and change of scene, with nourishing, but not rich food. But nearly always in severe cases local treatment is needed as well. Blistering the perinæum is most successful; several small patches should be painted over with blistering fluid on successive days, taking care to avoid the loose skin of the scrotum, and if possible not raising actual vesicles. Astringent injections applied to the part itself by means of a proper catheter, perforated with numerous small openings at the end, sometimes succeed exceedingly well, but they are occasionally followed by attacks of epididymitis which will assuredly be laid to their credit. Five minims of a two per cent. solution of nitrate of silver is a favourite application, though much stronger ones are used sometimes; even this nearly always causes severe burning pain, and a blood-stained discharge for one or two days. Care must be taken that the catheter is not passed into the bladder before the injection is thrown into the urethra, and that the mucous membrane of the latter, especially in the case of nitrate of silver, is washed as clear as possible beforehand. It may be repeated several times, at intervals of four or five days.

Enlargement of the prostate.—This is rarely or never found before the age of fifty-five. It may affect the whole gland, so that it still retains the normal shape, or only a part, one side or the middle. All the tissues may increase equally, as in a true hyperplasia, or the fibrous and muscular ones may grow to such excess that they form small rounded masses like independent tumours in its substance.

Symptoms.—The effect on the urethra and bladder depends on the part involved. If only the lateral lobes, the prostatic part may be elongated to as much as four inches without any obstruction; or a much smaller growth projecting from the middle line forwards, so that it cannot be felt from the rectum, may almost close the urethra. Enlargement is so common that it is said one in three of those over fifty-five years of age is subject to it in greater or less degree, but it is only in one-fifth of these that there is any interference with the exit of urine from the bladder.

When this does not occur there is merely slight inconvenience. At the commencement of micturition there is some hesitation; the urine is slow in coming, and cannot be ejected forcibly; the size of the stream may be very fair, but it seems rather to flow away, especially towards the end, the last few drops falling without control. There is no increased frequency, and the bladder scarcely suffers.

In about one-fifth, however, it happens that, owing to the shape of the growth, the bladder cannot be thoroughly emptied; a small but constantly increasing quantity of urine remains behind after each effort; the bladder is always more or less distended; micturition becomes more frequent, so that the patient often imagines he is passing too much urine; the bladder becomes irritable, and cystitis sets in.

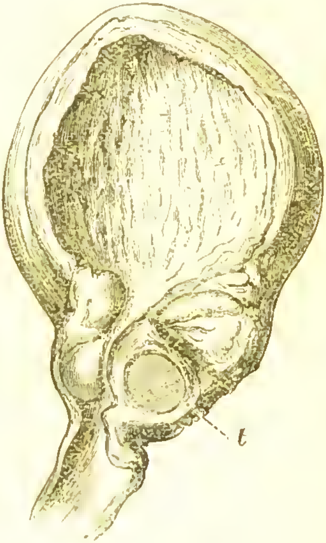

Fig. 55.—Fibroid Tumour of the Prostate (*t*). (Middlesex Hosp. Museum.)

The urine alters its character; at first it is clear and acid, and may remain so for a long time, but at length, owing to the admixture of mucus from the bladder, irritated by habitual distension, it becomes cloudy and neutral. In advanced cases it is ammoniacal from the decomposition of the urea by micro-organisms, intensely fœtid, turbid with muco-pus and phosphates, and nearly always contains traces of blood. Pain is generally present; severe when the bladder is distended and becoming worse as it contracts; felt at first over the pubes, but spreading soon to the perinæum and down the thighs.

The rectum becomes irritable, and owing to the constant straining, prolapse or hæmorrhoids make their appearance. In advanced cases defæcation takes place simultaneously with micturition; in earlier ones there is a constant teasing sense of fulness.

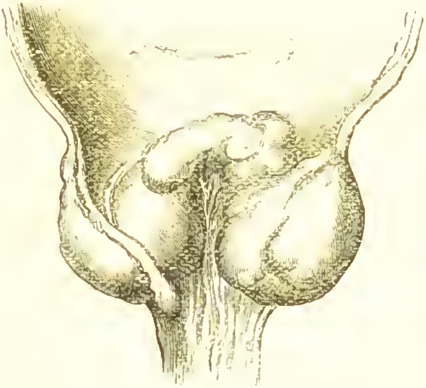

Fig. 56.—Nodular Tumours of the Prostate. (Middlesex Hosp. Museum.)

The night's rest is interrupted at a very early period, contrary to what takes place in calculous disease; frequency of micturition in enlarged prostate is always greater at night than in the day.

Complete retention sometimes is the first symptom of all, or it may be caused at any moment by constipation, exposure to cold, excesses of any kind, or anything that tends to produce congestion of internal organs. If it occurs early in the history of a case, and the bladder is much distended before it is relieved, atony, which may be permanent, and an expanded thin-walled bladder are the consequence. If later, when chronic cystitis has set in, the walls become dense and rigid, inelastic and hypertrophied.

(*See* Retention of urine.) True incontinence is very rare, though it may be caused by the median lobe enlarging and growing into the neck of the bladder so as to prevent its closing. Overflow of urine, on the other hand, following retention and caused by it, is very common.

The health soon begins to fail, the night's rest is always broken, the pain and anxiety never disappear, the bowels are disordered, and digestion impaired, exercise becomes impossible, and, above all, the kidneys become involved, so that the secretion of urine fails. Sometimes there is complete suppression, consequent on an attack of retention or operative interference; sometimes sloughing and ulceration round the bladder and urethra set in, or phosphatic calculi form; but most often there is a steady decline in the vital power, probably due to imperfect action of the kidneys, until some slight irregularity or exposure proves too much.

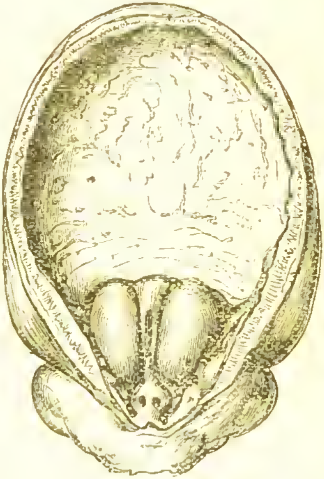
Fig. 57.—Hypertrophy of the Prostate.

Diagnosis.—Enlargement of the prostate can only be definitely ascertained by an examination of the urethra or rectum. The latter is best accomplished by introducing the finger well oiled while the patient is stooping forwards over the back of a couch, or more comfortably lying on his side with the knees well drawn up. The posterior surface and upper border of the gland may be explored in this way, and any irregularity in shape or resistance accurately determined.

The degree of obstruction may be best measured from the urethra with a silver catheter. If the middle lobe is much enlarged, the passage of the instrument is abruptly stopped until, by the depression of the handle, the point is sufficiently raised to ride over the obstruction. The length of the enlargement may be judged by the increase in the distance the catheter must pass before it enters the bladder. The most definite information is obtained by carrying on these two processes simultaneously. In this way the exact seat and amount of the obstruction can be made out without more than a sense of discomfort.

Enlargement, due to inflammation, is easily distinguished by the pain felt in examination, and by the sensation of heat and tenderness in the rectum; malignant disease by the rapidity of the growth, the frequency of hæmorrhage, and the softness of the swelling. Cysts and other forms of tumour are very rare, and would be dealt with according to the amount of obstruction.

Treatment.—The object is to prevent cystitis; but it is necessary to be careful that the means adopted do not of themselves excite it. It is due, in the first instance, to the bladder being unable to empty itself; this being unnatural, sooner or later sets up a slight amount of irritation. More mucus is secreted, and retained in the pouch behind the prostate until the acidity of the urine is so diminished that it becomes neutral, or even alkaline. Then decomposition follows, and the products being very irritating, make matters worse, so that when this once sets in there is great reason to fear that it will become permanent.

The remedy is to empty the bladder thoroughly at least once a day, though it may be necessary to do it more often. Habitual distension is avoided by this, and the tendency to cystitis checked. But to be successful this must be commenced before cystitis has set in; when it has once begun it is very difficult to get rid of it. As to the time when it is advisable to begin, the irritability of the bladder and the amount of residual urine are the safest guides. If, for example, the patient has to rise every night, or to pass urine several times of a morning while dressing; or if it is found on more than one occasion that after he has, as he thinks, emptied his bladder, several ounces still remain in the interior, even though it is acid and clear, there is no question that it is safer to commence. Cystitis may come on at any moment.

The catheter should be passed the last thing at night before retiring to rest. In this way several hours' sound sleep are secured, and, owing to the recumbent position, and the even temperature, there is less likelihood of any constitutional disturbance afterwards. The instrument should be the softest and most flexible possible. For purposes of diagnosis a silver catheter is best; if there is retention, it is advisable to take one with a longer and a larger curve; but if it has to be introduced every night, or several times a day, especially if it is to be entrusted to the patient, the most flexible that will enter should always be used. Sometimes a black one, bent up at the point (coudée) succeeds best, or a gum elastic which has been for some time kept over-curved on its stilet; or one of these may be passed with the stilet inside until it is brought to a standstill, when the catheter is to be quietly pushed in, while the stilet is being drawn back. In all cases, unless a stricture is present in addition, the largest instrument that will pass the meatus should be selected; but the utmost gentleness must be used.

It is essential to commence this plan of treatment as gradually as possible, and if the amount of residual urine usually present in the bladder is considerable, only to withdraw part of it at a time. The bladder, though not in a state of complete atony, has, owing to its habitual distension, lost its power of completely contracting, and needs careful adjustment to its new condition. Unhappily the kidneys are often involved even at this early stage, and then sometimes, in spite of every care, a low form of fever sets in; the symptoms are very vague, the rise of temperature is slight. and may be altogether absent; the tongue is red and dry; there is wandering delirium, especially at night, with a rapid failure of power, and the patient sinks from what is called exhaustion in the course of a few days. In nearly all these cases the urine will be found of low specific gravity, and loaded with albumen. (*See* also Retention and Cystitis.)

The general treatment of patients suffering from enlargement of the prostate must not be neglected; particularly if the median part is affected, congestion at the neck of the bladder, and complete retention, may come on at any moment. Constipation, an attack of indigestion, congestion of the liver, the use of stimulants, anything, in short, which can obstruct the hæmorrhoidal circulation, may produce it. Exposure to cold may bring it on, and so may violent exercise (especially riding), or sexual intercourse. Even an irritating condition of the urine, such as an excess of uric acid, is sufficient. The more simple and regular the mode of life, the less likely is it to happen.

Often, however, the time for this simple treatment is already past before the patient seeks advice; and even when it is commenced sufficiently early, and carried out with the utmost care, the time nearly always comes at length when, owing to the swelling and tenderness of the prostate resenting the continual passage of instruments, it is no longer possible. Retention or atony has occurred, or chronic cystitis has set in, or behind the prostate there are pouches which, in spite of continual washing out, are full of decomposing urine, or even contain phosphatic calculi; or the bladder has become thick-walled, rigid, or contracted, so that it must be relieved many times a day, even every hour. At length the suffering becomes intense; the patient is unable to pass water without an instrument; day and night there is the most agonising sensation at the neck of the bladder, and every attempt to relieve him by catheter only serves to increase the pain.

Operative treatment.—Under these circumstances the only hope of relief is to place the bladder in such a position that it may drain itself completely and remain empty, so that under perfect physiological rest it may be able to recover itself so far as it can. The hypertrophy and the rigidity of its walls cannot, of course, disappear, nor can the pouches be obliterated; but by giving free exit to the offensive urine the tendency to decomposition may diminish, and the mucous membrane may be able to recover itself, throwing off the coating of mucus and phosphate of lime that adheres to it.

With this object three different methods have been proposed: (1) perineal section; (2) prostatectomy, or excision of portions of the prostate; (3) Bottini's method, or what is practically the formation of a new channel by means of the galvano-cautery.

1. The first of these only aims at giving temporary relief, and is suited to those cases in which cystitis has gradually become acute, and the passage of an instrument difficult or impossible from the pain and swelling of the prostate. The patient is placed in the lithotomy position, a staff passed, and an incision just large enough to admit the fore-finger made into the membranous part at the apex of the prostate. The knife is laid aside, the finger pushed on into the

bladder, and then both it and the staff withdrawn. The whole operation is exceedingly short, and practically unattended by danger. There is no need to tie a tube in through the wound for the first day, and very often it may be dispensed with altogether; but where the wound has a great tendency to close, or the bladder does not drain well, or it may be considered advisable to wash it out, a tube may be introduced on a probe at any time. Such cases, however, always do best with the least interference, and there is no fear of extravasation so long as the external wound is free. The patient lies in bed, on a lithotomy mattress, and in general after the urine has drained away for three or four days, the congestion of the prostate subsides, the blood disappears from the urine, the mucous membrane begins to throw off its abnormal coating, and the fistula may be allowed to close. It has served its purpose; in a patient with diseased kidneys it has obviated the necessity of tying a catheter in the bladder, and has allowed the inflammation of the prostate and mucous membrane to subside; it has drained and given rest to an inflamed bladder without irritating it with a foreign body.

It is conceivable that by this method it would be possible in exceptional instances to diagnose and remove an enlarged and projecting median lobe, and so give permanent relief.

2 and 3. The other two methods aim at this directly, the one by punching out pieces of the prostate with an instrument shaped like a short beaked lithotrite, the other by the cautery. Cases in which such measures are advisable of course are rare, but where the patient is still young for his years, where the kidneys are sound, and particularly where the obstruction is due not so much to congestion of an enlarged prostate, from exposure to cold, or the use of catheters as to an actual increase in size of the median

portion, they deserve to be tried. Even after having been unable to pass urine except with the aid of a catheter for months, patients have recovered complete control over their bladder after these operations. The latter, however, it must be acknowledged, is attended sometimes with severe vesical tenesmus, and three weeks may elapse before the sloughs separate.

Atrophy of the prostate has been described both in old age and in young adults, probably due in many instances rather to defective development at puberty. It does not give rise to any symptoms.

Tubercular disease of the prostate occurs in acute tuberculosis as part of the general infection, and in connection with tubercular disease of the other urinary organs. The *symptoms* are those of chronic persistent inflammation of the prostate, running on to suppuration, and perhaps to complete destruction of the gland. The diagnosis can only be confirmed by the simultaneous infection of other organs.

Malignant disease of the prostate is more common. It is nearly always encephaloid carcinoma, though some of the instances in young adult life may have been sarcomata. There is a rapid increase in the size of the gland, with more or less obstruction to the flow of urine according to the shape of the growth, cystitis, decomposition of urea, and the formation of phosphatic débris. Pain is rarely absent, radiating from the perinæum to the loins and down the thighs; sometimes it is very intense. Hæmorrhages are common, often profuse, occurring with or without micturition, and tending greatly to reduce the patient's strength. Death usually ensues from exhaustion due to hæmorrhage, interference with the urinary secretion, want of rest, and pain before the glands or other organs are much involved, and before the growth fungates. Operative treatment is out of the question; the bladder must be relieved according to the circumstances of each case, without using a catheter oftener than is absolutely essential. In this way, at least, the cystitis and the loss of blood may be kept in check.

STONE IN THE BLADDER.

Varieties.—Urinary calculi may be divided into three classes, according to the reaction of the urine.

1. Acid. Uric acid; urates of ammonia, soda, or lime; oxalate of lime; cystin and xanthin; the last two being very rare.

2. Alkaline, when secreted by the kidney; bone earth, phosphate, or carbonate of lime. These also are very rare.

Both of these classes are formed in the kidney, and descend into the bladder.

3. Alkaline, from the decomposition of urea. This, the ammonio-magnesian or triple phosphate, is deposited in the bladder generally as a coating on other substances, rarely forming an independent calculus.

Growth.—Calculi increase in size while in the bladder by a deposit of fresh material on their surface, so that they are formed of concentric laminæ which may be composed of different materials, according to the changes in the composition and reaction of the urine at various times. Apparently they have the power of attracting from the urine any material with which it may happen to be overloaded, forming, as it were, a nucleus round which it is deposited; so that a calculus formed of uric acid in urine charged with that material descends from the kidney and collects round itself strata of the same substance; then, later, it may become coated with urates or oxalate of lime, or, if cystitis set in, with a layer of phosphates. The layers are never quite pure, oxalate of lime, for example, being always mixed more or less with uric acid; but the deposits of different reactions usually remain distinct.

The nucleus is for the most part a crystalline deposit of uric acid or oxalate in a colloid material, and a substance of similar character helps to bind together the inorganic salts. Anything, however, even a blood clot or collection of mucus, can serve as a nucleus.

Calculi may be simple or multiple. In the latter case they are either rounded by friction or marked by facets. They may be free or encysted, so that only one surface is exposed to the urine; all the fresh deposit takes place then on this side, and ultimately they assume a dumb-bell or mushroom shape.

They may be homogeneous, formed of the samo material throughout, or made up of different layers arranged round a nucleus, so that it is impossible to tell from inspection of the exterior what may be inside.

Distinguishing features.—In general they may be distinguished from each other by their shape, surface, colour, hardness, and the appearance presented by the cut section.

Calculi of *cystin* are very rare. They are usually ovoid in shape, mammillated on the surface, and of a peculiar waxy lustre and yellow colour, which, however, becomes dirty green after exposure to air. If a small portion is dissolved in liquor ammoniæ, six-sided crystals of cystin are deposited as it evaporates.

Besides these, calculi composed of *xanthin* or xanthic oxide, of a peculiar fatty substance mixed with phosphates (urostealith); of fibrin, blood, and even of silica have been described.

The character of the deposit present in urine when allowed to stand is of much importance in cases of calculi. There is no definite diathesis connected with the formation of different calculi as was formerly

GENERAL CHARACTERS OF THE MORE COMMON TYPES OF CALCULI.

	SHAPE.	SURFACE.	FRACTURE.	COLOUR.
1. Uric acid.	Ovoid or round.	Smooth or slightly warty. Susceptible of a fairly high polish.	Crystalline in proportion to its purity. Brittle, but hard.	Yellow to red, or reddish-brown.
2. Urates, chiefly of ammonia.	Ovoid.	Very smooth and earthy.	Earthy and inclined to crumble; homogeneous if it forms a whole calculus, but in general existing as laminæ.	Whitish-grey to fawn.
3. Oxalates.	Very irregular.	Tuberculated.	Crystalline and very hard.	Dark brown, even black.
4. Mixed phosphates.	Depends on that of nucleus.	Smooth and friable.	Chalky, soft, and breaking easily. Sometimes with many small crystals on the surface.	White or grey.

CHEMICAL REACTIONS OF THE MORE COMMON CALCULI.

1. Uric acid. 2. Urates:	Insoluble in hydrochloric acid; soluble when warmed with alkalies. Disappear, or almost disappear, in blow-pipe flame. With nitric acid and ammonia, give the murexide test.	
3. Oxalate of lime.	Soluble in hydrochloric acid. Do not disappear in blow-pipe flame.	Insoluble in acetic acid. After being heated, effervesces on the addition of an acid.
4. Mixed phosphates.	Do not give the murexide test. Not soluble when warmed with alkalies.	Soluble in acetic acid. Fuses when heated.

The latter may usually be distinguished from the former by giving off ammonia fumes when heated with a solution of caustic potash.

URINARY DEPOSITS · INORGANIC.

1. ACID URINE.

Uric acid.	Red-brown crystals, like cayenne pepper, on the bottom of the vessel. Rhombic prisms, with angles nearly equal, so as to resemble cubes; or elongated, with angles rounded off, and arranged in stars, radiating from a centre.	Due to malassimilation or an imperfect balance between oxidation and the presence of refuse nitrogenous material. Urine high coloured, and very acid. Common in badly-fed children of the poor; in gout; or where there is rapid waste of the tissues (as in fevers), or excess of nitrogenous material in the food.
Mixed urates.	Fawn or brick red deposit on side and bottom of vessel. No trace of crystals.	Met with under similar conditions. Uric acid often deposited later, when the urine is allowed to stand, owing to the increased acidity.
Oxalate of lime.	Colourless crystals, either octahedra or shaped like dumb-bells. The latter may be aggregated into "hemp-seed" calculi.	Due to dyspepsia, over-work, mental exhaustion, etc. Urine pale, abundant, and acid; generally with mucus.

2. ALKALINE URINE

Earthy phosphates.	White, chalky, very rarely forming calculi.	Due to diseases of nervous system, causing excess of phosphates; or to alkalinity of urine from presence of alkaline carbonates, from digestion, or other causes, leading to their precipitation even when not in excess.
Triple, or the ammonio-magnesian phosphates.	White, chalky crust on calculi or other foreign bodies, often showing signs of crystals.	Purely local in its origin; due to decomposition of urine, and not connected with any constitutional condition.

supposed, but not unfrequently valuable evidence of irregularities in assimilation may be obtained in this way. And besides, it gives the best information as to the condition of the urinary organs and the structure of the calculus, or, at least, its outer stratum.

Causes.—Calculi are either of local or of constitutional origin. The former consist of mixed phosphates, and are due to the decomposition of urea in the bladder; the latter are dependent on malassimilation, but nothing is known as to the immediate cause. They are more common very early and very late in life, and taking into consideration the numbers of people of different ages alive at the same time, there is no doubt a constantly increasing tendency to their formation as life advances. The male sex, as might be expected, furnishes by far the larger number, but it is impossible, for that reason, to say that it is more common in them. The children of the poor are peculiarly liable to it in comparison with those in a better station of life; in certain families it seems to be hereditary (cystin calculi certainly), and it is much more prevalent in certain countries and in certain districts than in others, but no satisfactory explanation of this long-known fact has been suggested.

Symptoms.—A calculus in the bladder is a foreign body that irritates it. The symptoms are most severe when the bladder is unusually tender (that is, when it is inflamed and the calculus phosphatic), when the calculus is rough and angular, and when it is more than usually shaken about by the movements of the patient. So long as the bladder is full the calculus lies in a fluid of higher specific gravity than water, so that though it does not actually float it cannot come into violent contact with the walls; as the bladder contracts, the symptoms become urgent.

1. Pain, of two kinds: first, acute, felt at the end

of the penis and towards the close of micturition, because then the sensitive mucous membrane at the neck of the bladder is contracting on the calculus; consequently not severe when the stone is encysted, when there is an enlarged prostate, or when the patient passes water in the recumbent position. Secondly, constant chronic pain, worse when the patient is moving about, felt across the loins, in the groin, and down the thighs. This becomes much worse when the bladder is inflamed.

Large calculi sometimes do not cause any pain; indeed, the only symptom to which very large calculi give rise is frequency of micturition, consequent on diminution in the capacity of the bladder.

2. Increased frequency of micturition, especially in the day time and during active movement, owing to the irritation of the walls of the bladder by the calculus. Later it may be due to the cystitis.

3. Hæmaturia. A few drops of bright blood following micturition coming from the mucous membrane where it is bruised by the calculus.

4. Arrest of the stream of urine by the calculus blocking the orifice of the urethra. Retention may be caused by its impaction at this spot. It is rare in adults.

5. Later, cystitis follows; the amount of mucus in the urine increases; pus and blood appear in larger and larger quantities; the kidneys become involved, and albuminuria sets in; tenesmus, prolapse of the rectum or hæmorrhoids follows, and the health is completely broken down.

Diagnosis.—The diagnosis can only be confirmed by the exploration of the bladder, by introducing a sound into the urethra, and by passing the finger into the rectum. It is advisable to give an anæsthetic for the purpose, especially in the case of children.

The sound may be solid or hollow, if the latter fluid can be let out of the bladder, or injected into it without removing the instrument. The handle should be wide and smooth, the curve short and abrupt, and the extremity larger than the stem. The pelvis of the patient should be raised, and the sound, well warmed and oiled, passed in the same manner as a catheter. The exploration of the bladder must be thorough and systematic, but as gentle as possible. It is easy to pass a sound over a calculus without touching it, both in children and in old men with enlarged prostate, but this is almost impossible if the finger is introduced into the rectum at the same time.

The ring of the sound against the calculus must be heard as well as felt; the spine of the ischium, the promontory of the sacrum (especially in children), or a rough ridge in the bladder encrusted with phosphates gives very much the same sensation. So also does suddenly stopping the fluid as it comes out of the bladder through a hollow sound if this is short and straight, and if the flow is forcible.

An attempt should always be made to estimate the size and position of the calculus (that is, if it is encysted) while the patient is being sounded. Sometimes the material of which it is composed may be conjectured from the clearness and distinctness of the ring. Calculi are removed by opening the bladder where it is uncovered by peritoneum either above the pubes or in the perinæum; or by crushing the calculus in the bladder, and allowing the fragments to come out either through the natural passage, or an artificial opening. Solvents have too slight an action on calculi, even when the composition is known and when it is of such nature that they can act on it, to be taken into serious consideration. Oxalate of lime is quite beyond reach; uric acid and urates may be benefited in exceptional cases by rendering the urine alkaline, but there is then always the danger of precipitation of phosphates. As a preventive measure there is something to be said in favour of cold water (especially during long fasts, and at night) and of frequent light meals, for by these means the urine is diluted and its escape hastened just when it is usually most concentrated and stagnant.

LITHOTOMY.

I. **Lateral.**—The deep incision carried through the membranous and prostatic parts of the urethra into the left lateral lobe of the prostate.

An aperient must be given the night before, and an enema the morning of the operation. The instruments required are a sound; a catheter and syringe for injecting the bladder or washing it out; a grooved staff, either straight or curved; lithotomy tapes, anklets, or Clover's crutch, for fastening up the patient; a lithotomy knife, or broad-bladed straight-backed scalpel; various pairs of forceps, and a scoop. Besides the usual instruments required for operations, a straight-back blunt-pointed bistoury may be needed to complete the deep incision; a blunt gorget for opening up the prostate, and a tube with an india-rubber bag adjusted round it so that if introduced into the wound the urine may escape through the tube while any hæmorrhage is prevented by inflating the bag.

The patient should be placed on a narrow, but well raised table, so that with the operator sitting opposite, the nates may be of a convenient height, and the anæsthetic administered.

The stone must be felt with the staff by the operator, and, as a wise precaution, by one of the assistants also. If this cannot be done the operation should be abandoned.

If the patient has not passed water recently there is no need to pass a catheter; but if he has, or if there is any doubt, it is as well to draw off the urine, and replace it with six to eight ounces of water of a proper temperature. Care must be taken, if bandages or lithotomy tapes are used, that the patient's hands grasp the soles of the feet, and that the bandage is fixed first by a clove hitch to the wrist, and then carried round the two together in a figure of eight.

The patient must be brought down to the end of the table, so that the nates project slightly, and the hips and knees being flexed, fastened in this position with one of the appliances already mentioned, the perinæum shaved, and the staff given to the assistant to hold. If it is curved in the ordinary catheter shape it should be held well up under the pubes, so as to separate the membranous portion of the urethra from the rectum, and grasped by the fingers, while the ball of the thumb is pressed against the flat of the handle. If the staff is straight, it is to be held well up, with the handle slightly inclined towards the operator.

The finger should be introduced into the rectum, to feel the apex of the prostate, to make sure the rectum is empty, and to stimulate the gut to contract, so that it may be out of the way. Then, the finger and thumb of the left hand steadying the skin, an incision is made from a point midway between the scrotum and the anus, just to the left of the middle line, downwards and outwards to below the anus, a little nearer to the ischial tuberosity than the orifice. This divides skin, superficial fascia, subcutaneous fat, external hæmorrhoidal vessels, and, perhaps, the superficial perineal vessels and nerves. The incision is then deepened by dividing the transversus perinæi muscle with the artery on it and the lower border of the triangular ligament, the fore-finger guarding the rectum in the wound. Some fibres of the accelerator urinæ may be divided, but not the bulb

The finger is then pressed into the upper part of the incision, so as to feel the groove in the staff, and if this is a curved one, the point of the knife is placed in the groove, dividing the compressor urethræ and the membranous part of the urethra. The handle must now be slightly depressed, the blade turned a little towards the operator's right, so that it may be opposite the longest diameter of the prostate, and pushed firmly onwards through some of the fibres of the levator prostatæ and the prostate itself. The incision may divide the whole length of the lower and outer side of the prostate up to the neck of the bladder, though this is attended in old people by severe venous hæmorrhage, but it must on no account divide the recto-vesical fascia. The fibrous ring at the neck of the bladder must be just notched; then the other tissues yield without injury to the fascia. If it is torn by the forceps the lateral ligament of the bladder gives way too. Moreover, if the incision is too small, the structures are so bruised during extraction, that inflammation, which is almost always diffuse, owing to the condition of the kidneys, inevitably results.

The knife is then withdrawn, the back being all the time pressed into the groove, and the finger gradually forced into the bladder by a twisting movement.

If the staff is a straight one, as soon as the point of the knife is placed well in the groove, the operator takes with his left hand the handle of the staff, lowers it till it is nearly horizontal, holding meantime the point of the knife quite still, and then turning staff and knife together on their long axis, so that the latter may be in the proper plane, and pushes it on until the resistance of the prostate is no longer felt. The extent to which the prostate is divided depends on the angle formed by the knife with the staff. With the straight staff used in this way as a director, it is much more easy to keep the knife in the groove and to make an incision sufficiently free without being too wide. The staff must not be withdrawn until the finger has entered the bladder, and if possible touched the stone.

If the perinæum is very deep, or the prostate much enlarged, a blunt gorget must be pushed along the groove, so as to divide the prostate, and the staff must be kept *in situ* until the forceps have been passed along it. As soon as the finger has touched the stone, and if possible fixed it and ascertained its shape, a suitable pair of forceps, well warmed, must be guided by it through the wound into the bladder, and the blades opened. Withdrawing the finger is generally followed by a gush of urine, which may carry the calculus at once into the grasp of the forceps, or a slight movement of the blades may enable it to be seized; but sometimes, especially when the calculus is of a peculiar shape, this is the most difficult part.

If it breaks up or is encysted it must be removed with the finger and a scoop. In all cases care must be taken to withdraw it in the axis of the pelvis, quietly and gently, easing it from the various structures that oppose it, and pressing the tissues off it with the finger. If unhappily it should break, it becomes necessary to wash out the bladder, perhaps many times, with warm water, in order to remove all the débris.

By this means, in the adult, a stone an inch and a half in diameter may be removed without dividing the recto-vesical fascia; one two inches across may possibly be extracted by drawing the stone well down and carefully dividing the tissues that resist, especially the right side of the prostate; but it may well be doubted whether it would not be better for such cases either to perform the suprapubic operation or to crush it first and then extract the fragments. Under no conditions is it advisable to make the incision first and crush through the wound, as the walls of the bladder must be bruised. Even the fracture of a calculus, when grasped by the forceps, adds materially to the danger, owing to the necessity of washing out the bladder, etc., to get rid of the fragments.

The last step in the operation is to explore the bladder with the finger, in case there should be a second calculus present.

Unless hæmorrhage is feared, there is no need to insert a tube in the wound; the urine drains away of itself through the opening for the first two days, and then somtimes comes by the urethra, owing to the swelling about the prostate. . As suppuration becomes more free, it pours out of the wound again, gradually diminishing in amount as healing progresses. The patient should be placed in bed, on his back, with the knees and hips bent, and the mattress so arranged that the urine will not flow up towards his shoulders.

The **accidents** that may occur are:

1. Hæmorrhage, from making the incisions too high up and wounding the bulb, or its artery, or an abnormal branch. If, owing to the depth, it cannot be tied, forci-pressure, acu-pressure, or even digital compression, by relays of dressers, must be kept up for twenty-four hours. The pudic itself, unless abnormal, is rarely wounded.

Venous hæmorrhage, especially from the prostatic plexus, may take place at the time or later, some hours after, and the blood may collect in the bladder and distend it before the occurrence is known. The coagula must then be washed out, and the bleeding checked by the pressure of an "air tampon," with a tube running through it to allow the escape of urine.

2. Wound of the rectum, especially when much

distended. Generally this closes, but it may leave a recto-vesical fistula.

3. Wound of the posterior wall of the bladder.

4. Missing the urethra altogether and opening the base of the bladder on the staff.

5. Tearing the urethra across: this, especially in children, from not making a free and clean incision into the membranous part. The tissues are so delicate that the urethra may be torn across, and the bladder pushed in front of the finger, which enters into a space that feels like the interior, lying between the rectum and the wall of the bladder. If the urethra has been pushed off the staff, the operation must be abandoned.

6. Allowing the back of the knife to diverge from the groove as it is withdrawn. With the straight staff this can hardly happen.

Difficulties of various kinds may be met with: false passages, enlargement of the prostate, especially when it is irregular; unusual depth of the perinæum; contraction of the pelvis, from rickets or tumours; encysted, or adherent calculus. The stone, too, may be of unusual shape or size, or phosphatic, so that it crumbles into a mass of slimy tenacious mortar at the slightest touch. In boys, the mobility of the bladder and its position high up in the pelvis increase the difficulty; in adults there may be sacculation, so that after the operation it is necessary to pass a double tube, one inside the other, so as to wash out the pouch as well as the bladder.

Causes of death.—1. Infiltration of urine into the cellular tissue at the base of the bladder, owing to the neck having been completely divided, and the recto-vesical fascia laid open. Peritonitis follows rapidly.

The symptoms are those of acute sthenic peritonitis; they come in within twenty-four hours, and usually prove fatal on the fourth or fifth day. Brodie saved one patient by laying the whole perinæum open into the rectum.

2. Diffuse inflammation of the areolar tissue at the neck of the bladder from bruising during the extraction of large calculi. Owing to the condition of the kidneys when large calculi are present, the inflammation is always diffuse, and spreads rapidly to the peritoneum and adjacent textures.

3. Hæmorrhage; not so much from the actual loss of blood at the time, as from the weakened and enfeebled state in which the patient is left.

4. Pyæmia, probably spreading from the veins.

5. Peritonitis, from wound of the bladder, where it is covered with peritoneum or extension through the walls of a cyst.

6. Shock and exhaustion.

7. Cystitis.

8. Suppression of urine.

The prognosis in lateral lithotomy depends on:

1. *Age.* — It is extraordinarily successful in children, and, as years advance, becomes steadily more and more dangerous.

2. The *size of the calculus.* — Either the lateral ligament of the bladder must be divided, or the prostate bruised in the lateral operation if a calculus is very large. In either case diffuse inflammation results.

3. The *state of the kidneys and bladder*, and the length of time the symptoms have lasted.—This is the most important of the three. Most of the fatal cases may be traced to diffuse inflammation or exhaustion, of which renal disease is the great predisposing cause.

II. **The median operation.** — The deep incision only through the membranous part of the urethra and the apex of the prostate.

The patient is prepared for operation in the same way, and placed in the same position, but a rectangular staff is used, as it brings the apex of the prostate nearer the surface, and lessens the danger of wounding the rectum. The incision is made in the median raphe, commencing immediately below the bulb; the urethra is opened at the junction of the membranous with the prostatic part, and a small incision made upwards so as to expose the staff fully, the back of the knife being towards the rectum. The finger is then gradually insinuated along the staff, following the upper surface rather than the lower, because the roof of the urethra is fixed more firmly than the floor, and there is less danger of tearing it across. When it reaches the bladder, the staff is withdrawn and the forceps taken up. This operation is essentially the same as that for exploration of the bladder with the finger.

Median *v.* lateral lithotomy.—The advantages of this over the lateral operation are:

1. Less hæmorrhage. Abnormal arteries cannot be cut, and the prostatic plexus is not opened.

2. The reflected part of the recto-vesical fascia, forming the true ligaments of the bladder, cannot be divided. In the lateral operation the fibrous ring at the neck of the bladder should be just incised, and the tissues will yield without this portion of the fascia tearing; but, particularly with the curved staff, the incision may be carried too far. The prostate is torn by the finger, it is true, in the median, but so it is in the lateral when the incision is only of moderate dimensions.

3. After the operation the urine does not come by the wound so much or so long. Healing takes place more quickly.

The disadvantages are:

1 Want of space, not only for the superficial, but

also for the deep incision; so that it is very hard to extract a stone more than one inch in diameter without badly bruising the neck of the bladder. The fascia is not torn, so that infiltration does not follow, but diffuse inflammation may.

2. In children particularly there is more danger of tearing the urethra across.

3. The bulb and the rectum are more likely to be wounded.

III. **The suprapubic operation.**—The bladder is opened above the pubes below the fold of the peritoneum.

The preparation of the patient is the same, but the position is the ordinary recumbent one. The bladder is to be carefully filled with warm water, or, better, an antiseptic solution, so as to raise the fold as high as possible; the urethra should be secured by a ring round the penis; and an indiarubber bag, provided with a stop-cock, so that it can be filled with fluid, should be introduced into the rectum, and distended in order to lift the bladder up from the pelvis.

The incision is in the middle line, three inches in length, with the lower end over the pubes; the linea alba is carefully divided, and the peritoneum pushed up. The soft cellular tissue and fat behind the symphysis are carefully separated with the finger or a blunt director in order to avoid wounding the large veins sometimes present; and the bladder is fixed with a tenaculum. The wall is then divided sufficiently to allow the finger to enter and feel the stone; if a large opening is required, it may be made either with a blunt-pointed bistoury towards the pubes, using the finger as a director, or by the fingers alone.

The forceps are then introduced, and the stone withdrawn; or the stone may be grasped with a small lithotrite through the urethra, and pushed upwards when the bladder is reached. The wound should be left open, both the deep and the superficial one. A tube is not required; it delays the healing without draining the bladder effectually or protecting the patient from the danger of infiltration; and it is almost impossible to close the wound in the bladder accurately by means of sutures. The patient should lie on his side to facilitate drainage, and should change from one to the other occasionally, so as to avoid excoriations.

Choice of method.—In children nothing can succeed better than the lateral operation for all calculi of ordinary dimensions. In the median there is always the danger of pushing the bladder in front of the finger. If the stone is exceptionally large the suprapubic method is advisable.

In adults much depends on the size and shape of the calculus.

1. Stones under an inch in diameter, or long and thin foreign bodies, such as a piece of bougie. Unless lithotrity is preferred, these are the most suitable for the median.

2. Stones under an inch and a half. Up to this size calculi may be removed by the lateral method, unless lithotrity is preferred.

3. Stones over this size. If soft and phosphatic, and the urethra capacious, a very large calculus may be removed by crushing; but in these cases the kidneys and the bladder are generally involved, and long operations are unadvisable.

If the stone is hard, the choice lies between breaking it into a few fragments with a lithotrite, and extracting these through a median incision, or performing the suprapubic operation.

4. The number of calculi is of some importance; many small ones (too big to be washed out with an

evacuating tube) are best removed, like the fragments of a large one, by the median operation.

5. The situation of the calculus sometimes determines the incision. If behind the prostate, and particularly if embedded in the substance of the gland, it may most easily be reached by the median incision; but it may be encysted in other parts.

Other points to be considered are: (*a*) The size of the pelvis; this may be seriously diminished by tumours, rickets, etc. (*b*) Atony of the bladder, perhaps after crushing. Here the median operation should be performed and the bladder thoroughly evacuated without delay. (*c*) Loss of blood; this may be serious in the lateral operation.

LITHOTRITY.

The calculus is crushed, and the fragments evacuated through the urethra by means of a metal tube the size of No. 16 English catheter. Unless there is something quite exceptional, the operation is finished at one sitting. The prolonged, but gentle, use of instruments is less dangerous than leaving the bladder full of angular fragments (any one of which may become impacted at any moment) and subjecting the patient to the risk of many operations.

Lithotrites differ according to the work they have to do. They should be cut from a solid bar of metal, not forged. In introducing a lithotrite, the shape of the end must be taken into consideration; as a rule, when it is approaching the bulb, if it is supported in the vertical position, its own weight carries it in.

The evacuating tubes are merely large thin-walled catheters (Nos. 14, 16, and 18; English sizes), with openings in various places to suit different conditions. The aspirator which is attached to them consists of an indiarubber bulb, to be grasped by the hand, and an intervening portion made of glass, so that the fragments may be seen and trapped, and not be sent back again with the stream. A current of fluid is driven into the bladder with each squeeze, and sucked out again (with the fragments) when the pressure is withdrawn.

Operation.—Either the patient should be placed under an anæsthetic, or the bladder and urethra should be rendered insensitive by injecting into them about two drachms of a four per cent. solution of cocaine. This succeeds admirably for about ten minutes or a quarter of an hour, if the walls are not coated over with an absorbing layer of ropy mucus; at the end of that time a second injection is necessary. The pelvis should be well raised, and the operator should stand on the right.

If the patient's bladder is not irritable, and is known to contain a certain amount of urine, it may be left: but generally speaking, it is better to draw this off, and inject six or eight ounces of a warm antiseptic solution. Care must be taken, when the aspirator is used, not to inject too much, or with too vigorous a hand; it often happens that parts of the bladder are thin-walled and soft from degeneration, so that it is quite easy to rupture it.

When the lithotrite is introduced, there are two methods of grasping the calculus: in the first the female blade is pushed down on to the floor of the bladder, so that the stone drops into it and is caught by the male blade; in the other, the instrument is inverted and the calculus sought for on the floor, with the blades pointing downwards. The latter is decidedly best when the prostate is enlarged, and it involves less moving of the lithotrite in the after work. Care must be taken in both, but especially the former, that the male blade, as it is withdrawn, does not pull the calculus away from the female blade.

As soon as it is firmly grasped the stone should be crushed, if soft, by the pressure of the hand, but in general by steadily screwing the male blade into it. As a rule, the fragments drop vertically, so that if the lithotrite is used gently, and no currents are raised, the larger ones are picked up at once and crushed again until small enough to come through the tube. The lithotrite is then withdrawn, taking care that the blades are well home without any fragments caught between, the catheter passed, and the aspirator attached. Each compression sends a stream of fluid into the bladder, and each relaxation withdraws as much, the broken pieces coming out at the same time, but dropping down out of the way into the glass receiver. In this fashion a calculus of moderate size may be broken up at one sitting, and the bladder washed quite clear, the catheter acting as a sound to ascertain if a fragment is still present. One too large to come out either blocks the eye, and must be detached by squeezing the bulb again, or knocks against it, so that it can be felt or heard as the fluid pours out. Every fragment must be removed.

Small calculi of uric acid, and moderate sized ones of phosphate of lime, may be sufficiently crushed with a small lithotrite without removing it from the bladder; but in the case of oxalate of lime, or large calculi of uric acid, it is best to make use of two instruments, a strong one to break them up, and a slender one to complete the operation.

If the urine is acid and if the kidneys are sound, the *after-treatment* of the case is very simple. There is always some cystitis from the use of lithotrites with, perhaps, hæmaturia, but if the cause is thoroughly removed this soon subsides of itself. The patient is better in bed, without stimulants or rich food; he may be given a hot bath every day, and any irritation about the neck of the bladder may be subdued by morphia suppositories and hyoscyamus and buchu internally.

When the calculus is phosphatic and the urine alkaline, not only are accidental complications more likely to follow, although the calculus is softer, but after it has been removed the cystitis is still kept up by the state of the urine. If this is ammoniacal, and particularly if the walls of the bladder are irregular, sacculated, or atonic, so that it cannot rid itself of the mixture of decomposing urine and mucus, the condition is most unfavourable. The kidneys are certainly involved, and every kind of trouble is more likely to happen.

Complete atony may come on. In old people this sometimes follows the simple introduction of a catheter. It is due in part to the muscular coat, in part to the feebleness of the nervous system, which is unable to withstand the shock. If the stone is crushed and removed at a single sitting, the bladder has simply to be relieved by catheter. When the evacuation of the fragments was left entirely to nature it was more serious and necessitated median lithotomy.

Cystitis is very common, and when the urine is ammoniacal, very serious. The mucus mixed with the alkaline products of decomposition becomes tenacious and ropy, forming, with the phosphates, a slimy and offensive coating on the lining membrane. The patient is poisoned by absorption from the putrid mass; the tongue becomes dry and red, and typhoid symptoms set in. The mucous membrane may slough in places; or abscesses may form in and round the prostate; or peritonitis may ensue from gradual extension through the thinned wall of a cyst; or, more common than all, the septic decomposition travels up the ureters and sets up acute suppurative nephritis in kidneys already diseased. (*See* Cystitis and Surgical Kidney.)

Suppression of urine comes on occasionally, especially when there is old renal mischief. It seems to be due to some reflex disturbances of the vasomotor or secretory nerves.

Constitutional symptoms in all degrees of severity may follow; either simple malaise with headache and slight fever, or rigors with high temperature and delirium, preluding pyæmia (probably spreading from the prostatic plexus), septicæmia, acute nephritis, or suppuration in or round the prostate and the walls of the bladder.

The prognosis in lithotrity depends on the condition of the bladder and the kidneys. Age and size of calculus are, it is true, very important, but rather from the troubles they cause than for themselves. If a patient's urinary organs are sound a calculus of any reasonable size may be crushed with as great security as a small one.

LITHOTRITY COMPARED WITH LITHOTOMY.

There are certain conditions in which one of these only is applicable. In children, lateral lithotomy is so successful that lithotrity is rarely tried; in encysted or adherent calculus it is impossible.

On the other hand, if the patient is over puberty, if the urinary organs are fairly sound, and if the calculus is under certain dimensions (two inches for uric acid and one and a half for oxalate of lime) there is no doubt lithotrity is best. Larger calculi should be dealt with, as already mentioned, by the suprapubic method or by crushing and median lithotomy.

Cases of stricture, or of enlarged prostate of moderate size, do not preclude crushing; the difficulty is confined to those instances in which the calculus is phosphatic, the bladder inflamed or sacculated, the urine ammoniacal, and the kidneys diseased, especially when this occurs in conjunction with old age. Both the lateral method and crushing under such circumstances are very serious operations, but it will be noticed that there are two conditions in the selection. So far as the state of the kidneys and the age are concerned, the cutting operation is more serious than the crushing. Patients may not recover from the latter, but they probably will not from the former. The special danger in lithotrity is the condition of the bladder, which in lithotomy is not so material. But this can be obviated to a very considerable extent by the use of antiseptics, by care in the manipulation of instruments, and, if it is absolutely necessary to drain the bladder and give it free exit for its decomposing contents, by opening the urethra in the perinæum. Where small phosphatic concretions form repeatedly, as they sometimes do in cases of enlarged prostate and cystitis, there is no doubt that lithotrity is best.

Calculus in the female.—This is much more rare than in the male, owing to the ease with which a calculus can pass through the urethra, and to freedom from the cystitis that is caused by enlarged prostate. It is probable, too, that owing to the difference in the mode of life, fewer renal calculi are formed in females than in males.

The *symptoms* are much the same, but incontinence of urine and bearing-down pains are more common. As in the opposite sex, it sometimes happens that very large calculi exist without giving rise to nearly such acute symptoms as the smaller ones.

The urethra in the adult female may be dilated so as to admit the fore-finger with but little fear of subsequent incontinence, so that small calculi, or those of elongated shape, and foreign bodies, may readily be extracted. Larger ones should be crushed first and washed out; the attempt to extract through the urethra too large a calculus may be followed by sloughing of the anterior wall of the vagina.

Very large calculi may be extracted by the suprapubic operation; by an incision through the wall of the vagina, which is then to be treated as a vesicovaginal fistula; or by introducing a staff into the urethra and making a modified lateral incision.

Calculus impacted in the urethra.—This is very rare, except in children, though it may occur after lithotrity if the fragments are left in the bladder.

The calculus must be a small one; and it may be impacted at the neck of the bladder, in the membranous part, or in the penile portion. The *symptoms* come on suddenly during micturition: the stream stops abruptly from the spasm and congestion excited, even if the calculus is not sufficiently large to block the urethra of itself; there is intense pain, the child screaming and pulling at the end of its penis; a drop or two of blood may come from the meatus; and there is complete retention. If left to itself, ulceration and extravasation of urine follow; indeed, in male children, impacted calculus is the most common cause of retention and extravasation.

If the calculus is in the penile part, it may generally be worked forwards by the fingers until it reaches the orifice, when a small incision may be necessary; or it may be extracted with urethral forceps; but the mucous membrane is less injured by the former proceeding. If it is fixed, or too far back, the skin over it may be stretched with the finger and thumb of the left hand, and a small longitudinal incision may be made on to it. The wound should be left to granulate. If deeper still at the neck of the bladder, it may be extracted by the median method, or pushed back with a blunt bougie, and the lateral operation may be performed.

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